COMBINED ANIMAL, DAIRY AND POULTRY SCIENCE

EXTENSION WORKSHOP

held at the

JOINT ANIMAL, DAIRY AND POULTRY SCIENCE ASSOCIATION ANNUAL MEETING

St. Louis, Missouri

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Edited by

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USDA/CSREES/PAS

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Preface

Volunteer committee members from the American Society of Animal Science, American Dairy Science Association, and the Poultry Science Association consulted with colleagues in their respective societies, industries, and allied industries to supplement their opinions of the best cutting edge presentations for this workshop. After considerable discussion, the list of topics and potential speakers was reduced to a manageable level. We depend on speakers to provide the high points of the discussion topic during the presentation, and additional pertinent information in the proceedings. This information will also be published in the Journal of Applied Poultry Research, as peer review articles.

We hope the workshop and proceedings are beneficial in your programs or business. Please use the evaluation form, or otherwise provide your opinion of topics and speakers. Additional copies of the proceedings are available from the editor.

Introduction and Washington Update

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Introduction

Workshop speakers will address topics in four sections: environmental, biosecurity, international opportunities, and extension realities. While water quality continues as a major management consideration for animal agriculture, air quality has moved to a similar high level of concern. Of great importance for all regulatory initiatives is the absolute requirement for a strong basis in objective repeatable research. Societal concerns, and how we can approach the development of creative solutions based on honesty and mutual respect, are major issues for agriculture.

Biosecurity is directly tied to environmental and health issues. Management of catastrophic animal mortality levels may be conducted using several procedures, with an important one being composting. Natural or other sources of microorganisms may result in extensive disease spread (e.g., fomites, such as sharing equipment between farms or dust from live-haul vehicles; vectors, such as people, pets, or pests). The absence of good biosecurity measures facilitates the spread of disease from all sources.

Today's economy is global. So are opportunities for agriculturalists. Likewise, decisions made by people or coalitions in other countries may directly and indirectly modify industry decisions in the USA. Among the major issues on the horizon are those related to immigration. Cultural issues in America have not been solved to date, and will undoubtedly intensify in the future. We should be prepared to effectively deal with these and other issues through research and educational assistance (e.g., conflict resolution) to our industries and society.

Niche markets have been the haven of the small producer. Over the years, niche markets have been claimed to be mostly ignored by our land grant universities and government researchers. These markets are now seen as growth opportunities by some large companies. Extension personnel are on the front lines in all of these issues and will play a significant role in defining the direction and resolution of these challenges. The latter will be true only to the extent we are prepared to understand and respond to all issues and prevent or ameliorate negative situations.

General Comments

This report contains a wide range of information that may be of interest to you. The purpose of this update is to provide a short summary of events and opportunities of interest to animal, dairy or poultry system personnel, particularly those in Extension who directly interact with the industry. These personnel must stay abreast of environmental, animal welfare, outreach, grant options, professional, societal and other issues. If you find an item that would be beneficial to personnel in other departments or commodity areas, please pass it along.

Some issues are non-competitive because they require cooperation, and not conflict, positional bargaining, or political versus science-based data to make decisions to achieve the best long-term solutions. These issues are those related to the environment, food safety, animal-being, and seemingly "minor" situations such as wrongly defining fighting cocks as gamebirds. People's livelihoods can be at stake.

Time spent planning rather than reacting to situations is often a luxury, but must be moved to a higher priority. An example of cooperation in planning and professional development is the Triennial Poultry Extension Workshop, which is now a biennial event. We continue to develop and implement innovative programs based on relevance to animal agriculture and societal requirements through multi-state research committees, special grants and other mechanisms. As a team, we are achieving excellent synergy and impressive results through cooperation and networking. One example is the Swine Housing and Well-Being project, funded through Purdue University, where an educational package is being developed. Another example of cooperation by faculty and industry volunteers is the American Poultry Historical Society recognition of career contributions to the poultry system through their Hall of Fame, located at the National Agricultural Library in Beltsville, Maryland.

As always, anyone wishing to be part of program planning and development is welcome. If you are not called, take the initiative and volunteer. If these opportunities are not available in your professional organization, make it happen.

Personnel

Special Recognition Award

The Annual Poultry Extension Special Recognition (a.k.a. Golden Cup) Award was initiated to acknowledge the extra efforts of extension personnel in national programs. This award is taken directly from the similar presentation to Dairy extension personnel by Basil Eastwood. The 2004 award is presented to Mike Hulet, from The Pennsylvania State University. Mike has had an exceptional record while at Virginia Tech and at Penn State. He has quietly taken a leadership role in several national and regional programs that deal with environmental protection and management issues. For example, for many years he has made significant contributions to the National Poultry Waste Management Symposium, and is the coordinator for 2004. Many other persons have made significant contributions to national and regional programs, and these efforts are also greatly appreciated.

USDA/CSREES

Dr. Muquarrab Qureshi came to CSREES from North Carolina State University on June 15 of last year. Muquarrab is our National Program Leader for Genetics, and is a welcome addition to our Plant and Animal Systems group.

Responsibilities

Swine Well-Being Project

After unavoidable delays, the National Swine Housing and Well-Being Symposium and educational/training project will be completed this summer. We have completed the extensive literature review (Cindy Smith, National Agricultural Library, Animal Welfare Information Center, AWIC) on swine housing, and the proceedings from the symposium from June 2002, both of which are available from the AWIC in printed or electronic formats. Copies of the video from this symposium were made available to many educators and non-governmental organizations. Additional copies will be created if there is sufficient demand. The video/DVD (Ed Pajor, Purdue) will be completed soon, and will be added to the educational package that contains the bibliography and proceedings on a CD. All will be provided to the LGU system, commodity and activist organizations, and farmers. Funds were made available for the USDA CSREES and the USDA Agricultural Research Service (ARS) to provide assistance to the animal industries in the area of animal well-being. The USDA ARS used their funds for swine housing research at their facilities and at universities, and the CSREES educational efforts complemented the ARS research activities. Purdue University is the lead university for these CSREES programs.

Department Reviews and Multi-State Research Committees

Department reviews are an important part of my position, and are assigned through the CSREES system. April 30 was the deadline for university administrators to submit requests for department or other reviews. However, this has been a flexible schedule.

USDA/CSREES Liaison responsibilities are with several multi-state research projects: 1. NCR-131, Animal Behavior; 2. S-292, The Poultry Food System: A Farm to Table Model; 3. W-195, Poultry Production, Processing and Water Quality; 4. NE-127, Biophysical Models for Poultry Production Systems; and, 5. WCC-204, Animal Bioethics.

The WCC-059 regional research committee has been authorized as a full research committee, with the designation change to W-195. For 2004 they plan to meet in Germany and have a workshop with peers from Europe in November. For more information, contact Mike Hulet at 814.863.8934 or Theresia Lavergne (Chair; LA) at 225.578.2219.

The NCR-131 (Animal Behavior) met June 18, at Purdue University, in conjunction with the International Society for Applied Ethology. The writing committee for the NCR-131 is in the process of making the NCR-131 a full research committee. This conversion is an essential activity which will stimulate greater interest in committee membership. This same upgrading is encouraged for WCC-204. These are important committees because they provide opportunities to be involved in emerging issues and provide scientific responses to some of these issues that will have tremendous impact on all of food animal production in the future. It would be beneficial to your state's industries and your department if you would consider participation on both these committees.

A significant difficulty with participation in cutting edge multi-state research projects that involve new areas of science, such as integration of welfare and behavior (NCR-131) in research protocols, is the lack of respect provided during promotion and tenure consideration. Evidently, this is particularly true for areas outside the traditional animal sciences. Animal bio-ethics (WCC-204) also helps faculty and the animal systems address ethical and other issues of societal concern. These and other coordinating committees appear to be further marginalized regarding financial support in most universities due to their status as being only coordinating committees. This topic should be discussed more broadly during our professional meetings.

NPL's now review and approve Hatch Act projects submitted by all institutions participating in the Multi-State project before funds are released for project support. In a June 1 memo, NPL's are now instructed to also make a final review of proposed (new and revisions) of Multi-State projects, and affirm that the programmatic goals and objectives are consistent with the Hatch Act, fall within the broad strategic objectives of USDA and CSREES, and that the project should be approved by the Administrator of CSREES. A comprehensive and thorough set of procedures has been established in each region for the development, peer review, and monitoring of progress for each project. The National Information Management and Support System (NIMSS) was recently developed by the State Agricultural Experiment Stations to facilitate the tracking, retrieval, and management of the national portfolio of multi-state research projects. NPL's are assigned to multi-state project/committees to represent CSREES.

Meetings

Combined Animal, Dairy, and Poultry National Extension Workshop

The current meeting is a modification of the PSA National Extension Workshop, which has a volunteer Chair and volunteer Editor of the on-site proceedings. The Proceedings have been published as an on-site handout for several years because they have been considered a valuable reference, which also documents the high quality of our workshops and numerous regional and national programs. This year, the proceedings will also be published in the Journal

of Applied Poultry Research. Committee members for this workshop are: Dale Blasi (KS; ASAS), Rhonda Vann (MS; ASAS), Tom Troxel (AR; ASAS), Mike Shutz (Purdue; ADSA), Marcia Endres (MN; ADSA), Bob Peters (MD; ADSA), Peter Robinson (CA; ADSA), Theresia Lavergne (LA; PSA), Lee Cartwright (TX; PSA) and John Carey (TX; PSA). We continue to depend on James Rock, retired from the University of Connecticut, who has provided evaluation leadership for many years. PSA Extension Workshop Committee members for 2004 formally submitted topics and speakers for consideration by the combined workshop committee, and they are: John Blake (AL), Hart Bailey (MS), Ralph Stonerock (OH), and Brian Fairchild (GA), Matthew Burnham (TX) and Theresia Lavergne (LA). On behalf of the attendees, I want to express to committee members our appreciation for the time and expertise they have provided to make our program relevant and a success. Please see me if you want to work on this committee.

Sponsorship is a complex and divisive issue, particularly when committee members are asked to obtain all or a significant portion of the funds needed to support non-member speaker travel. This situation, unless well organized and coordinated, may cause hard feelings with society members and industry. Creation of potentially negative relationships may reduce our ability to obtain support for research, extension or teaching projects and may reduce the Chair's ability to find volunteers to be on their organizing committee.

Future Trends in Animal Agriculture (FTAA)

The purpose of the FTAA is to create opportunities for positive dialogue between industry and animal activists, so common ground may be identified and important issues addressed. The intent of the symposia is for industry and activist group personnel to also better understand the complexity of these issues. Discussions are to promote progress in identifying ways to improve animal well-being, which may also result in a balanced and comprehensive approach to dealing with related societal issues. These issues include environmental, food safety, and rural infrastructure concerns.

After a series of one-day programs in the late 1980's and early 1990's, the FTAA efforts were discontinued. A committee composed of industry, activist group, specialty market representatives, and government, recently renewed the concept and programs of the FTAA. They created a successful symposium in September 2002 in Washington, DC. The title was: "Current Status and Future Expectations of Food Animal Production Standards: Optimizing Animal Well-Being and Social Responsibility". They held a round table discussion on May 28, 2003 in Washington DC, "The Science and Ethics Behind Animal Well-Being Assessments", suggested by Lew Smith, USDA/ARS and developed by Don Lay, USDA/ARS. The FTAA then developed a symposium for September 17, 2003, "Sharing Costs of Changes in Food Animal Production: Producers, Consumers, Society & the Environment". In 2004, the symposium "Local and Global Considerations in Animal Agriculture: The Big Picture", will be held on September 22. All meetings are open to the public, with the primary audience being congressional staff personnel and members, and agency decision makers and other personnel. The meeting will hopefully result in enhanced respect for diverse opinions, and the goal of animal well-being rather than organizational agenda well-being. Contact me for a copy of any of the proceedings.

Bio-based Plant Nutrient Products: Quality Assurance, Marketing, and Regulations

The purpose of the symposium is to provide a forum for education and discussion of recent advances in quality assurance and marketing of stabilized organic production, and related regulations. In addition, educational material will be provided regarding the utilization of bio-based products, such as compost, as nutrient sources for plants. The workshop will discuss cutting edge topics and emerging issues and related regulations that impact compost nutrient utilization, and potential solutions to challenges.

Prioritized recommendations will be developed and included in the proceedings. The intended audience of university educators and researchers, agricultural consultants and nutrient management specialists, and Federal and state government personnel. The workshop will be held on Sunday, October 31, 2004, in conjunction with, and with the logistical support of, the Tri-Societies (Crops, Soil and Agronomy Sciences) Annual Meeting. The location is the Convention Center in Seattle, Washington

The workshop will be co-sponsored by the US Composting Council (USCC), USDA Agricultural Research Service (ARS), USDA Cooperative State Research, Education and Extension Service (CSREES), with other organizations welcome. The Tri-Societies will use this program as part of the educational process for their members and potential members and should be considered a co-sponsor if they so desire. Contact Pat Millner (ARS; 301.504.8387), Jim McNelly (USCC; 320.253.5076) or me (202.401.5352) for more details.

Southern Region Poultry Extension Workshop (Triennial)

Texas will be the site of the 2005 Southern Region Poultry Extension Workshop, which now represents all Extension regions. The location will be in Arlington, Texas at the La Quinta Hotel. Look for notification of dates and local arrangements. The Triennial workshop Chair is John Carey (TX; 979.845.4318), and Ken Anderson (NC; 919.515.5527) is the Vice Chair. *Please provide your program format and speaker/topic ideas to John or Ken.* Non-poultry science personnel are welcome.

Unless someone else volunteers, Ken Anderson will provide an evaluation for the next Workshop. All states are requested to provide a state report for the proceedings. Frank Jones (AR; 479.575.5443) will lead the sponsorship committee, but he needs others to help him with this task. Please contact Frank directly and copy John Carey. Also contact John to volunteer to help on a specific committee.

An organizational meeting will be held at the US Poultry and Egg Association International Exposition at the World Congress Center in Atlanta, Georgia in January, 2005. Suggested representatives from the other regions are: Midwest: Kevin Roberson (MI); Northeast: Mike Darre (CT); West: Doug Kuney (CA). While each state or region should ensure a person is at the planning meeting, everyone is welcome to participate.

National Poultry Waste Management Symposium

The 2004 National Poultry Waste Management Symposium will be held October 25-27 in Memphis, Tennessee. This workshop focuses on poultry, but the principles and most if not all the environmental issues apply to all animal species. A transition team has successfully transferred coordination responsibilities to Land Grant University personnel. Mike Hulet (PA) is the Coordinator for 2004, with Susan Watkins (AR) Coordinator in 2006. We need another responsible person for 2008. The Alabama Poultry and Egg Association has volunteered to assist the organizing committee by being responsible for the financial aspects of the program. We could not have been as successful in our several environmental protection programs over the years if not for the efforts by Wanda Linker, with support by Johnny Adams at the Association. It is essential for the success of this meeting to have reliable volunteers to head the different committees and personnel to work on the committees. *Please Contact Mike Hulet (814.863.8934; mrh4@psu.edu)* at the meeting, and Susan Watkins (479.575.7902) to help on a 2006 committee or attend the meeting.

US Poultry and Egg Association (USPEA) International Exposition

We hold several organizational meetings at the USPEA meeting in January each year, and appreciate their continued support. These include: National Poultry Waste Management Symposium, National Egg Quality School, National Egg Products School, several multi-state

research committees, PSA Extension Workshop, PSA Extension Committee, Triennial Poultry Extension Workshop, and the American Poultry Historical Society Annual Meeting. Contact me if you want to schedule a meeting so it does not conflict with one of these meetings, or contact the USPEA directly. Everyone is welcome to participate in most of these meetings, particularly the APHS, NPWMS, and Extension committees. For other meetings, contact the Chairperson. The schedule will be available through email and at the registration desk for the Southern Poultry Science Society Annual Meeting.

USDA Related Information

Grants

The new procedures to follow when applying for grants, and release of grant information from CSREES, with application forms and deadlines, can be found at: http:www.reeusda.gov/fundingopportunities/requestforapplications. If you can not directly access the files, use of an abbreviated address may prove successful.

ADDS, and e-Extension

The ADDS Program, Agricultural Databases for Decision Support, is still alive and crawling steadily forward. Funding has been received from the National Sheep Industry Improvement Center to put the sheep and goat materials up on the web in the decision array format. The pork industry is moving forward to re-develop the pig database, using a similar graphical browser approach, under the leadership of the National Pork Board. The dairy, beef, environmental management, and milk composition infobases are available at http://www.adds.org . The dairy infobase is available in the decision array format on a three month free trial basis. There is currently a $35 charge for the beef infobase. The rest are available at no charge.

Each of the ADDS projects and the products produced are owned and controlled by the folks that developed them. There are separate groups that have addressed the development of the dairy, beef, sheep, goat and swine projects. The environmental management product grew out of a compilation of each of the species/commodities projects and also includes the appropriate CRIS reports.

We are working to get each of the infobases available without charge because this is an impediment to their use. Also, the lack of funding for the ADDS Program has made updating a problem where we are on a pay as you go basis with the ADDS Center. We would like to make it possible for the folks who have worked on these projects to control their own section and project.

ADDS has been involved in "e-Extension" work for about ten years and grew out of several earlier electronic database developments. An effort similar to ADDS, called e-Extension is being initiated this year. e-Extension will be funded, at least initially, by .8% of the Smith-Lever 3b & c Federal formula funds received by each state. Three positions are to be filled to begin development of e-Extension, a director, associate director for content and associate director for technology. Once these positions are filled we will need to determine how our current projects fit into the e-Extension plans.

Organic

Organic regulations are in place. Many organic, natural or "sustainable" farmers have complained the Land Grant University system has provided essentially zero research or management assistance. Their complaint is that the LGU's focus on making big farms and companies bigger, with maximum profit and least cost production the over-riding goal. To many, it would seem appropriate for LGU administrators and personnel to find innovative ways

to assist these taxpayers who are attempting to make a living in these niche markets. To view the regulations, access the Internet site: www.usda/nop.

Jacquie Jacob, (MN) has scheduled a breakfast meeting this week to discuss the potential for an animal organic multi-state research committee. There is interest by some food science faculty and it is important to have participation by production and health professionals. Please feel free to attend and develop networks to support meaningful programs in this area.

Portfolio Evaluation

CSREES is in the process of responding to a request for a formal analysis of our portfolio of programs. One important outcome of the report to the review team was the identification of the need to be able to document quantification of extension programs that are often primarily qualitative in nature. The suggestion was made that the Current Research Information System (CRIS) be modified to accommodate this need. Under today's climate of increasing demands for accountability by all segments of government, formula funds may not be guaranteed for tomorrow. Having an expansion of CRIS to allow the search and summary of extension's impact, preferably in dollars, will significantly improve our ability to defend the need for extension related funds. It may be appropriate to consider some relief from present reporting requirements to allow this expansion of CRIS to include extension. You might consider asking your clientele what your work means to them, as a dollar value, and include these numbers in your reports.

Projects

National Poultry Infobase (NPI)

The NPI continues to languish due to insufficient enthusiasm on the part of poultry system personnel. Insufficient personnel, excessive alternative opportunities, and time are the biggest problems. We are finalizing the CD, which will complete the project. Please see Nick Zimmermann (MD; 301.405.2805) or Jacquie Jacob (MN; 612.6242766) for details. CD's will be distributed to co-sponsors. A second edition will primarily be dependent on industry interest. Poultry will continue to be represented on the Board of Directors of ADDS, Inc.

Animal Well-being Assessment

The Animal Behavior and Welfare Group (ABWG) at Michigan State University received a USDA Challenge Grant to develop a web-based animal welfare assessment course, using interactive media. They also provide leadership for the Animal Welfare Judging Contest for college level students. Students evaluate CD-based situations of farm animal management and provide their reasoning to university faculty who judge their responses. In 2004, students from eight universities participated. We are in the process of transferring this concept to 4-H and FFA competition as an assessment of food animal husbandry practices. The youth programs will be geared to Senior or Juniors in High School, and tied closely to the collegiate assessment contests.

Distribution Lists and Subscription email Lists

I will continue to rely on e-mail as the primary system to get information to you. Due to computer changes, the distribution lists USDA-poultry, USDA-rabbit, 4h-poultry or 4h-rabbit mail groups are discontinued. Tell me if you want to be added to other lists, such as: animal rights/welfare, agro-terrorism, game birds, water quality, food safety, and those related to the multi-state research projects. Contact me if you think an additional listing would be beneficial to poultry or animal science professionals.

Poultry Science Resource List

Publication of the Poultry Science Resource List (PSRL) has been taken over by the Poultry Science Association, and updated this year. The list includes contacts for rabbits and is available at the PSA Internet site (www.poultryscience.org). To ensure its continued availability, it is important to inform PSA Board of Director members we appreciate their efforts in continuing this project. If you have information you want included that will help your program, or when you find errors, please let us know at that time. Send the information to Jim Kessler, Susan Pollack, or Mary Swenson at PSA Headquarters, or to me. Changes will now primarily be made on an as-needed basis, rather than every three years. Also, the PSRL will be available for review and comment when PSA has a promotional booth, such as at the Annual Meeting.

PSA 2004 Texture Technologies Corporation Support Personnel Award

The Texture Technologies Corporation Support Personnel Award for the Poultry Science Association is in the second year and recognizes the essential contributions of farm, laboratory and other personnel. The purpose of the Support Personnel Award is to acknowledge the long term contributions by support personnel, and to recognize their work as being critical to the ability of faculty to receive the awards for which they are eligible to compete. This Award is the only professional level award of its kind, and supplements any existing university awards. We gratefully acknowledge the support of the Texture Technologies Corporation for their support.

Ms. Deborah Posey was selected as the recipient of the Support Personnel Award for her exceptional contributions to the success of Dr. Nelson Cox and other team members at the Russell Research Center in Athens, Georgia. The award will consist of: 1. a check for $500; 2. an appropriate commemorative plaque, inscribed with the person's name and the statement: "For outstanding contributions to the Russell Research Center and the Poultry Science Association in support of scientific and educational objectives."

The persons nominated for the 2004 award were all exceptionally qualified for the award and had a wide range of backgrounds. Fourteen persons reviewed the nomination packages. Nominators are highly encouraged to resubmit their packages for 2004, and others in industry, government and universities are encouraged to nominate their personnel. The bottom line is that faculty members and other researchers are extremely fortunate to have such high quality personnel supporting their programs. As was the premise for initiating this award, many exceptional people are working in our system and should be recognized for their contributions.

Now that some of the kinks have been worked out of the procedure, this concept is being suggested to the ASAS by Don Beermann and Richard Reynnells for their consideration as an ASAS award. It would seem appropriate that other professional organizations could also consider this possibility for their organization.

ENVIRONMENTAL SESSION

Concentrated Animal Feeding Operation (CAFO) regulations impact and record keeping requirements for livestock operations[1]

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ABSTRACT: In 2002, USEPA revised regulations for concentrated animal feeding operations (CAFO) to appropriately update federal requirements in the 1972 Clean Water Act, and specifically the National Pollutant Discharge Elimination System (NPDES). The goal of the revised regulations is to ensure clean surface water in the US. The revisions address runoff control, manure storage, nutrient utilization, and record-keeping and related livestock water quality issues. CAFO is defined by facility, risk of nutrients entering water, and size. Large CAFOs have at least 1000 cattle, 700 dairy, 2500 finishing swine, or 125,000 broilers. Smaller operations can be designated as a CAFO under some circumstances. By December 31, 2006, nutrient management plans (NMP) and record keeping are required for CAFOs. The USEPA requirements are the minimum requirements to which individual States must respond. State requirements may be more demanding and comprehensive than the minimum established by USEPA. Comprehensive Nutrient Management Plans (CNMP) are defined by USDA to monitor nutrient flow, minimize excretion, appropriately utilize nutrients, and keep records. CNMPs are more comprehensive than NMP and address feed management and alternative uses or technologies for managing manure. NMP records that must be maintained for five years include: the annual NMP, analysis of manure and soils receiving application, crop nutrient requirements, the basis for determining the rate of application, dates and methods of application, amounts of N and P applied, and a cropping season summary. The USEPA regulations require that CAFOs submit an annual report. USEPA is allowing the States to determine the threshold at which manure application rates can no longer be based on crop N need or removal and P-based application are required. This threshold is affected by several that define the potential for runoff P loss from individual fields. Considerable education efforts are underway nationally, regionally, and through land-grant institutions.

Key words: Nutrient management, Regulations, Animal feeding operations

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[1]A contribution of the University of Nebraska Agricultural Research Division, Lincoln, NE 68583. This research was supported in part by funds provided through the Hatch Act.

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Introduction

In 2003, the Clean Water Act was revised and new rules adopted for concentrated animal feeding operations (CAFO). Historically, the 1972 Clean Water Act prevented CAFOs from discharging runoff contaminated with manure nutrients into surface water unless rainfall exceeded a 25 year, 24 hour rainfall event based on historical climatic records (Sweeten et. al., 2003). This rule established CAFOs as a point source by defining size categories for confined livestock and therefore, required a NPDES (National Pollutant Discharge Elimination System) permit. This paper will highlight major changes in the revised CAFO rule with particular focus on nutrient management and recordkeeping. More information is available from the Livestock and Poultry Environmental Stewardship (LPES) Curriculum published by the MidWest Plan Service, or web accessible at: www.lpes.org.

CAFO definition

Concentrated animal feeding operations are defined based on operation and size. If livestock are confined in open, outdoor pens for more than 45 days in a 12-month period and the area is devoid of crops or forage residues. Animal feeding operations can be classified by size category (Table 1) into large, medium, or small. Large animal feeding operations are defined as CAFO. Medium animal feeding operations may be classified as CAFO if animals are in direct contact with surface waters, a man-made conveyance transports contaminated water to surface waters, or if the state permitting authority defines it as a CAFO. Small animal feeding operations are seldom classified as CAFO unless animals are in direct contact with surface water or a man-made conveyance is used as above. For the most part, only large and medium animal feeding operations will be impacted by these rules.

Table 1. Size categories for selected species that comprise animal feeding operations which determines whether the operation will be classified as a CAFO

Species	Large	Medium	Small
Beef cattle	>1,000	300-999	<300
Dairy cows	>700	200-699	<200
Dairy heifers	>1000	300-999	<300
Swine (<55 lb)	>10,000	3,000-9,999	<3,000
Swine (>55 lb)	>2,500	750-2499	<750
Turkeys	>55,000	16,500-54,999	<16,500
Layers	>82,000	25,000-81,999	<25,000
Broilers	>125,000	37,500-124,999	<37,500

By definition, any runoff from areas housing animals, feed storage, or where animals are handled requires control if operation is classified as a CAFO. An NPDES permit is required and runoff control must meet the standards of a 25 year, 24 hour storm.

Nutrient Management

Portions of this section are reprinted from Livestock and Poultry Environmental Stewardship curriculum, fact sheet authored by Ron Sheffield, University of Idaho, and Julie Paschold, University of Nebraska, courtesy of MidWest Plan Service, Iowa State University, Ames, Iowa, 50011-3080 and your land-grant universities. *Copyright © 2003.*

CNMP vs. NMP

The comprehensive nutrient management plan (CNMP) is a USDA-defined plan that minimizes nutrient excretion, ensures proper storage of manure and manure-contaminated water, specifies the application of manure nutrients at agronomic rates, and requires the maintaining of appropriate records. The NMP required for an NPDES permit is designed to be a subset of activities in a CNMP that relate to compliance with the effluent discharge limitations and other requirements of the NPDES permit.

Phosphorus-Based NMP

EPA is requiring large CAFOs to evaluate the potential for both nitrogen (N) and phosphorus (P) loss on every field receiving manure, litter, or process wastewaters. Manure applications may be limited or eliminated on fields that have a high potential for P loss. Medium and small CAFOs are required to "land apply manure, litter, or process wastewater in accordance with site-specific nutrient management practices that ensure appropriate agricultural utilization of the nutrients in the manure, litter, or process wastewater."

Producer Checklist: NMP

Producers can use the checklist below to identify mandatory issues that an NMP must address. Un-checked items represent issues that may need additional attention. In preparing an NMP, it is critical that the following planning, management, and documentation procedures are in place for all CAFOs.

Facility Design and Management

____ Develop and implement a NMP.

____ Ensure that the production area is designed, maintained, and operated to contain all of the manure, litter, and process wastewater including storm water plus runoff from the 25-year (or 100-year for new swine, poultry, or veal operations), 24-hour rainfall event.

____ Dispose of animal mortalities to prevent discharge of pollutants to surface water; and, cannot be managed in the liquid manure or process wastewater collection systems (unless specifically designed to treat mortalities).

____ Divert clean water from the production area.

____ Prevent direct contact of confined animals with waters of the United States.

____ Ensure that chemicals and other contaminants handled on-site are not disposed of in any manure, litter, process wastewater, or storm water storage/treatment system.

Land Application

____ Identify appropriate site-specific conservation practices to be implemented, including buffers to control runoff.

____ For large CAFOs: Maintain a setback area at least 100 feet from any down-gradient surface waters, open tile intake structures, sinkholes, agricultural well heads, or other conduits to surface waters where manure, litter, and other process wastewaters are not applied. (As a compliance alternative, a 35-foot vegetated buffer where manure, litter, or other process wastewaters are not applied. A CAFO can also demonstrate that a setback or buffer is not necessary or can be reduced).

____ Identify protocols for appropriate testing of manure, litter, process wastewater, and soil.

____ For large CAFOs: Collect and analyze manure, litter, and other process wastewaters annually for nutrient content, including N and P.

____ For large CAFOs: At least once every five years, collect and analyze representative soil samples for P content from all fields where manure, litter, and other process wastewaters are applied.

____ Establish protocols to land apply manure, litter, or process wastewater in accordance with site-specific nutrient management practices that ensure appropriate agricultural use of nutrients.

____ For large CAFOs: Land apply manure, litter, and other process wastewaters in accordance with an NMP that establishes rates for each field based on the technical standards for nutrient management established by the director of the state regulating agency.

Record Keeping

____ Identify specific records that will be maintained to document the implementation and management of the NMP.

____ For large CAFOs: Maintain all records on-site for five years. These records must be made available to the permitting authority upon request.

____ For large CAFOs: Submit an annual report to permit authority (director of the state regulating agency or EPA Regional Office).

Producer Checklist: Record-Keeping Requirements for Large CAFOs

Producers can use the checklist below to identify mandatory records that must be kept on-site for five years. Unchecked items represent issues that may need additional attention.

____ Expected crop yields

____ The date manure, litter, or process wastewater is applied to each field.

____ The weather conditions at the time of application and 24 hours before and after application.

____ Test methods used to sample and analyze manure, litter, or process wastewater and soil.

____ Results from manure and soil sampling

____ Explanation of the basis for determining manure application rates

____ The calculations showing the total N and P to be applied to each field, including sources other than manure.

____ Total amount of N and P actually applied to each field, including calculations.

____ The method used to apply the manure.

____ Dates that manure application equipment was inspected.

____ Maintain for five years

____ Site-specific NMP is on-site.

____ When manure or process wastewater is transferred to other persons, they are provided with current nutrient analysis and the recipient information is documented in records.

Producer Checklist: Annual Report

All CAFO owners are required to submit an annual report. The report summarizes the amount of manure generated, applied, and exported from the operation. Producers can use the checklist below to identify mandatory issues that must be addressed in an annual report. Unchecked items represent issues that may need additional attention.

____ Number and type of animals

____ Total amount of manure produced

____ Amount of manure transferred off-site

____ Total acres available for land application

____ Total acres used for land application

____ Summary of discharges from production area and land application area (not including agricultural storm water discharge)

____ Whether a certified NMP planner was used

Recordkeeping

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Summary of CAFO Regulations

New U.S. Environmental Protection Agency (EPA) regulations define the following minimum required records that must be in place no later than December 31, 2006:

- Results from manure, litter, and process water and soil sampling
- Test methods used to sample and analyze soil and manure, litter, or process wastewater
- Dates manure, litter, or process wastewater is applied to each field
- Weather conditions at the time of application and 24 hours before and after application
- Explanation of the basis for determining manure application rates
- Calculations showing the total nitrogen (N) and phosphorus (P) to be applied to each field, including sources other than manure, litter, or process water
- Total amount of N and P actually applied to each field, including documentation of calculations for the total amount applied
- Methods used to apply the manure, litter, or process water
- Dates of manure application equipment inspection
- Expected crop yields

Producer Note: CAFO operators must maintain all records for a minimum of five years

In addition, the EPA rules require:

1. All CAFO operators to maintain on-site a copy of the site-specific nutrient management plan (NMP).
2. Large CAFO operators to maintain records on the transfer of manure or process wastewater to other persons, providing them with current nutrient analysis and documenting recipient information in records.
3. CAFO operators to annually submit a report to the permitting authority

Since most states have the authority for implementing these CAFO regulations, individual states will define the actual record-keeping requirements expected of livestock and poultry operations. The EPA rules establish a minimum requirement with states having the authority to exceed that minimum. Producers should become familiar with state regulations and the language of the NPDES permit issued by an individual state when deciding what records are necessary.

Some suggestions about the types of records that producers might need to maintain to comply with the federal regulations are provided.

Below you will find a recommendation for appropriate records based upon the compliance language contained within the EPA rules (standard text) and *recommended, voluntary records for successfully managing manure resources (italicized text).* As individual states with permitting authority write their own implementation rules for the CAFO regulations, better guidance may be available on record-keeping requirements to meet individual state needs. The information below is also designed to suggest key topic areas that might serve as file or notebook dividers.

Soil Analysis Reports

A large CAFO operator must collect and analyze soil samples for P at least once every five years for all fields under the CAFO's control that receive manure. The required information for a soils report includes:

___ Soil P content ____ Date sample received ____ Farm and field ID

The soils report provide the basis for a crop nutrient recommendation. Depending upon the procedure for making crop nutrient recommendations, several additional types of information would be suggested:

___ *Soil nitrate content* ___ *Organic matter* ___ *Soil pH*
___ *Soil sample depth* ___ *Potassium, micro-nutrients, and soluble salts*
___ *Soil test method used*

Manure Sample Reports

All manure sources under the control of a large CAFO operator must be sampled at least once a year with records maintained for:

___ Total manure N content ___ Total manure P content ___ Date sample received

For a manure analysis report to be beneficial to the producer, the lab should report additional critical information including:

___ *Organic and ammonium N content*
___ *Moisture or solids content*
___ *Potassium and micro-nutrients critical to a crop's fertility program*
___ *Electrical conductivity for liquid manures to be irrigated onto growing crops*
___ *Manure source: storage facility or animal housing*

Test Method for Soil and Manure Analysis

The EPA CAFO regulations require that a CAFO operator maintain a record of the test method used to sample and analyze manure and soil. The following records should be included in a record book:

___ A standard operating procedure (SOP) should be developed by the producer and shared with employees for sampling each source of manure or wastewater. Suggested sampling procedures can be found in (1) MWPS-18, Section 1, Manure Characteristics (see references); (2) Sampling Manures for Nutrient Analysis, http://www.ianr.unl.edu/pubs/wastemgt/g1450.htm; and (3) at your local Cooperative Extension office for your state's land-grant university recommendations.
___ A producer-developed SOP for sampling soils. Check with the local Cooperative Extension office for your state's land-grant university recommendations or with a local Certified Crop Advisor for recommended procedures.
___ Laboratories follow standard procedures for analyzing for individual manure and soil characteristics. The CAFO operator should ask the lab performing the analysis for a copy of the SOP (or list of procedures with their reference) followed for each manure and soil characteristic indicated as required above.

Planned Nutrient Application Rates

To comply with the NMPs of the new CAFO regulations, a CAFO operator will need to provide an "explanation of the basis for determining manure application rates as provided in the standards established by the Director." To meet this requirement, the record book should include a standard procedure for calculating:

___ Crop nutrient requirements (or removal rates).
___ Nutrient credits from soil residual nutrients, legumes, organic matter, irrigation water or other sources (specific credits will vary with state and region).
___ Availability of organic (manure) and inorganic (commercial fertilizer) nutrient sources.
___ Field-specific planned application rates of organic and inorganic nutrient sources.

In addition, the producer should prepare and maintain, on-file, an annual field-specific plan for manure and fertilizer application prepared in advance of any nutrient application. The record book should include an annual field-specific summary of those calculations including:

___ *Crop nutrient requirements* ___ *Nutrient credits* ___ *Availability of nutrients*
___ *Recommended manure and fertilizer application rates* ___ *Field N and P balance*

Actual Nutrient Application Rates

The CAFO regulations require that one's records summarize "actual nutrient application rates" for both organic (manure, litter, and wastewater) and inorganic (commercial fertilizer) sources. A record sheet for actual manure application should include the following information:

___ Field name
___ Date of application
___ Acres covered
___ Application rate or total amount (manure)
- Number of loads for solid manure spreader or slurry applicators and average capacity OR
- Pump start and stop time and pumping rate for irrigation and towed hose applications OR
- Depth of application for sprinkler irrigation

___ Dilution water addition for irrigation applications
___ Application method *(including timing of incorporation relative to application)*
___ Weather conditions during application, 24 hours prior to application, and 24 hours after application.
___ Setbacks maintained
___ *Operator initials*

A record sheet for fertilizer application should include:

___ Field name
___ Date of application
___ Application amount
___ Product applied
___ *Application method (including incorporation/surface application)*
___ *Operator initials*

Cropping Season Summary

At the conclusion of a cropping season, field-specific summaries should be prepared. This information provides feedback for altering the NMP for next year. This end-of-the-year summary should include:

___ Actual crop yields. Since expected crop yields (required by CAFO regulations) are based upon cropping history, actual crop yields are needed. The method for validating these crop yields (e.g., yield monitor, FSA (USDA Farm Service Agency) validated record, crop consultant report) should also be noted.

___ A summary of actual field-specific nutrient application rates should be assembled for each field based upon the above records. This summary may be a copy of the field-specific plan discussed in the "Planned Nutrient Application Rates" updated to include actual manure and nutrient application rates.

Manure Application Equipment Inspections

The EPA CAFO regulations require that a CAFO operator "periodically conduct leak inspections of equipment used for land application of manure, litter, or process wastewater." The required and recommended records supporting these inspections include:

___ Date of manure application equipment inspection
___ *Type of equipment inspection*
___ *Checklist of items reviewed in inspection for potential leaks*
___ *Maintenance performed on land application equipment*
___ *Dates of maintenance*

The date of inspections is the only required record-keeping activity for land application equipment inspections. However, unless more detailed information is maintained, this lone requirement has little or no benefit to the producer or the general public.

Manure Transfer to Off-Farm Users

Livestock or poultry operations that import a significant portion of the animal feed or mineral requirements from off-farm sources have the greatest potential risk associated with nutrient accumulation on their farm. To balance the purchases of N (as protein) and P, export of manure is often essential to avoiding accumulations of nutrients within a livestock or poultry operation. Large CAFO operators transferring manure to off-farm users encounter only a few modest regulatory requirements. The end-user should not encounter any restrictions unless the manure is mismanaged. Large CAFO operators must record the transfer of manure to off-farm uses including:

___ Date of manure transfer
___ Amount of manure transfer
___ Name and address of recipient
___ Was recipient given copy of most recent manure nutrient analysis report?

A report of the quantity of manure transferred off-farm must be assembled and included with the annual report that is filed with permitting.

Crop Nutrient Status Indicators | Operator Training and Certification Programs | Discharges Associated with Land Application

A variety of other records may be considered that may not be required as part of a farm's records. However, some of these records can be beneficial in managing manure and documenting your farm's efforts to implement a good stewardship ethic. Some options that might be considered include:

___ *Records of any measure of crop N status. As producers apply manure at agronomic rates, the risk of reduced crop yield increases. Variation in manure nutrient content, ability to deliver uniform manure applications, and weather conditions (which influence the availability of manure N) all add to the risk of reduced yields. A growing number of tools are available for monitoring the N status of a crop and producing better NMPs that include manure.*

___ *Workshops, field days, staff trainings, and other education activities should be recorded for all farm employees. These activities demonstrate a farm's commitment to stewardship as well as contributes to a work force capable of implementing NMPs.*

___ *Discharges from equipment used in manure application typically must be reported to the regulatory authority within 24 hours with a follow-up written report prepared within seven days. Check state-specific regulations on reporting. Although a record of those reports is not listed in EPA rules, such documents should be included in a farm's record-keeping systems for nutrient management.*

Time Line for Compliance

The owner of a livestock or poultry operation defined as a CAFO must comply with all nutrient management requirements including the record-keeping requirements by December 31, 2006.

References

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Waste Management Alternatives: Composting, Methane Production and other Options

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Introduction

Proper waste management is one of the most important considerations for animal and poultry operations. Storing, handling, managing and proper utilization of the by-products from production have come to the forefront in recent years. For example, Maryland passed the Maryland Water Quality Improvement Act in 1998, which regulates nutrient management for both organic and inorganic nutrients used in crop production. Other states have nutrient management mandates; some voluntary and some mandatory. In many cropping systems phosphorus will be the limiting nutrient but nitrogen evaluation may be mandated for some nutrient management plans. Nutrient management plans should take into consideration the nutrients applied from commercial fertilizers and organic sources.

Some possible alternative uses for animal and poultry manure/litter are as follows:

1. Direct land application
    a. Applied at point of generation
    b. Transported to a location that can use the nutrients
2. Composting for value added markets
3. Processing poultry litter as feed for ruminants (not an option effective 2004)
4. Combustion
5. Organic fertilizer manufacturing

In many animal and poultry production areas land application at the point of generation may be limited by a nutrient management plan. Thus, producing an excess of manure/litter will result in it having to be utilized in a different manner other than land application at the point of generation. Our focus will not include direct land application.

Composting

Composting of organic waste has been used for centuries. Its use in bio-solid stabilization increased in the 1970's and 80's as alternatives to land filling, ocean dumping and incineration. As municipalities face disposal problems for their organic materials, so do food processors and farmers. In addition to stabilizing organic materials, compost has some additional benefits. Rynk et al., 1992 suggested some potential benefits are as follows:

1. Enhanced soil fertility and tilth
2. Destruction of undesirable microorganisms
3. Reduce or eliminate unpleasant odors
4. Environmental risk reduction

Why Compost Works

Composting is a biological process of decomposing organic materials into a humus like product. The process will occur naturally, but can be "speeded up" and controlled if proper ingredients are blended together. The controlled composting process is usually considered an aerobic

process, which requires oxygen. The decomposition process is a "slow cooking" process and not a rotting process. Microorganisms are considered the "work horses" of the composting process.

How Compost Works

In order to generate a healthy compost process, seven key elements are needed. They are as follows: a proper nutrient mix; moisture; oxygen; temperature; pH control; porosity; and time.

Proper Nutrient Mix

A proper nutrient mix is often referred to as the recipe; this is a blending of carbonaceous and nitrogenous materials together to form a desired carbon: nitrogen ratio (C: N). The ratio may vary from 20 to 35:1. Lower C:N ratios will produce rapid activity at the beginning; however, more odors will be given off in the process. A C:N ratio of 20:1 should be considered the minimum in formulating compost mix recipes. To assist in "recipe making" Brodie, 1994a, at the University of Maryland, developed a computer spread sheet. The spreadsheet allows the user to select the organic material(s) to be composted, then the program will indicate least cost recipe(s) based on the carbon sources available. Many scenarios can be evaluated, and a compost mix selection made in a very short period of time. In addition to the C:N ratio, Rubin and Sheldon (1993) suggest a C:P ratio of 100:1 to 150:1. A proper recipe is very important to successful composting. The end product is no better than the feedstocks used to make the recipe. Normally, animal and poultry waste do not have the proper C:N for good composting. Table 1 shows C: N ratios for dairy and beef cattle, swine, horses and poultry as excreted. From the table the C:N ratios for cattle manures are the highest except horse manure. In actual practice some of the C:N ratios will be higher depending on the bedding used in a particular production system. Cattle manure will compost with little or no carbon added unless it is added as an absorbent because the moisture content is too high. To reduce ammonia volatility, additional carbon will have to be added to swine and poultry manure/litter to adjust the C:N ratio to 20 or better. Yard trimmings and leaves, as a carbon source would be a good combination with the manures. Many landfills will no longer landfill yard trimmings and leaves. Soiled bedding in horse operations would also be a good carbon source.

Table 1. Nitrogen, Total and Volatile Solids and C: N ratio of various manures as excreted

Type Manure	N lb/da/1000lb	Total Solids lb/da/1000lb	Volatile Solids lb/da /1000lb	C:N ratio
Dairy Cow (milking)	0.45	10.00	8.50	10
Dairy Cow (dry)	0.36	9.50	8.10	13
Beef Cow	0.30	7.30	6.20	10
Beef (feeder)	0.31	6.78	6.04	11
Beef (feeder lot)	0.21	9.60	4.80	13
Swine (0 - 40 lb)	0.60	10.00	8.80	8
Swine (40-220 lb)	0.42	10.00	5.40	7
Swine Sow (gestating)	0.19	2.50	2.13	6
Swine Sow (lactating)	0.47	6.00	5.40	6
Poultry (layers)	0.83	15.10	10.80	7
Poultry (pullets)	0.62	11.40	9.70	9
Poultry (broilers)	1.10	20.00	15.00	8
Poultry (turkeys)	0.74	10.90	9.70	7
Horse	0.28	11.00	9.35	19

Source: SCS National Engineering Handbook, Agricultural Waste Management Field Handbook. 1992 and amendments.

Moisture

Moisture in the range of 40-60 percent is acceptable for composting. There are times when the moisture will be at the extremes of the range. In research at Maryland, 50 percent moisture has worked well in our composting efforts. Without a scale and convective or microwave oven, how can the moisture be estimated in a compost mix? One field method is the hand squeeze test. In the hand squeeze test, a hand full of the compost mix is obtained and squeezed into a ball by forming a fist. As the fist is released, the ball should expand but remain intact. The hand will be moist but not too wet. The squeeze test, as described, will approximate 50 percent moisture in the compost mix. Moisture levels greater than 60 percent may also cause a supernate (liquid) to leach from the compost mix and cause anaerobic (odor-causing) and other undesirable situations. Moisture is a key ingredient. If the moisture is too low or too high, the composting process will not function properly.

Oxygen

Oxygen is required to maintain the composting process in an aerobic state. It is desirable to maintain aerobic conditions for odor control and multiplication of thermophilic microorganisms associated with this process. As the oxygen is depleted, one of the indicators may be the lowering of temperature in the compost mix. However, measuring the oxygen content of the compost mix is a more reliable way to determine oxygen depletion. In compost mixes having very high BOD_5 loads, oxygen requirements will be great. It may not be possible to supply the oxygen requirements by just turning. To overcome this situation some systems may be aerated with a fan and piping system or a combination of mechanical and aerated systems.

Temperature

Temperature is generated in a compost mix by the metabolism of microorganisms (bacteria, fungi and actinomycete). If the recipe, including proper moisture and oxygen, has been blended together correctly, the microbes will begin the metabolism process. The microorganisms associated with the process are mesophilic (moderate heat loving) and thermophilic (high heat loving) species. Mesophilic microorganisms operate at temperatures less than 110 F (43 C). Thermophilic microorganisms operate at temperatures ranging from 110 to 150 F (43 to 66 C). Good composting temperatures range from 135 to140 F (57 to 60 C), composting temperatures of 150 F (66 C) for organics from animal and poultry origin are desirable to assure the destruction of pathogenic bacterial and viral organisms.

pH

pH is another item that may be critical at times, particularly if it exceeds 8. If a compost mix has a pH of 8 or greater, ammonia (NH_3) volatilization may become a problem, because it will cause odors. The desirable pH range is between 5.5 and 7.5. In some processes, depending upon the material, the pH will decrease over time to approximately 7; in others the pH will increase. You have to be on the guard for shifts in pH. If the pH is out of the desirable range, appropriate chemical action to alter the pH may be desirable. If the pH is too high, blending ferrous sulfate or other high acid products into the compost mix has been found to be an effective pH control agent (Carr and Brodie, 1992).

Porosity

Porosity as defined by Rynk, et al., 1992 is as follows: "a measure of the pore space of a material or pile of materials. Porosity is equal to the volume of the pores divided by the total volume. In composting, the term porosity is sometimes used loosely, referring to the volume of the pores occupied by air only (without including the pore space occupied by water)." Large carbon particles greater than 1-inch in size can assist in creating this pore space and are not usually part of the C: N ratio determination.

Time

Time for compost to mature is dependent on the mix recipe, moisture, feedstocks used, and particle size, turning frequency, temperature and end use of the product. A compost requiring only pathogen reduction that can be utilized as a green compost will require much less time to process than a mature compost. Check with your state regulators concerning the requirements you have to follow as a compost site operator.

Composting Techniques

Four composting techniques will be discussed. These techniques will "speed up" the composting process over natural composting. The techniques are: static pile; aerated static pile; windrow and in-channel.

Static Pile

Static pile is where the compost mix is piled and not disturbed for a long period of time. It may be turned, but not frequently. To assist in natural aeration, the initial compost mix should have a porosity of approximately 30 percent or a bulk density of approximately 900 lb./yd^3.

Aerated Static Pile

Aerated static piles can be active or passive in mode of operation. The active piles normally draw air through the compost mix by using pipes or plenums placed in the compost mix and fans attached to the duct system. Air discharge from the fan system can be filtered through a biofilter for odor control. Another aerated pile system is passive in operation. The passive system uses a series of perforated 4 or 5-inch plastic pipes underneath the compost pile. The pipe ends are left open and a natural convective process provides oxygen to the compost mix. A porosity of approximately 30 percent or a bulk density of approximately 900 lb./yd^3 is also desirable for the aerated pile system.

Windrow

Windrow composting can be accomplished outside or in a large, covered structure. Windrows are normally mixed with some type of turning equipment. The equipment can be as simple as a front-end loader, or self propelled equipment that straddles the windrow and turns it in one pass. However, mixing may not be as effective using the front-end loader as with the turning device. A porosity of approximately 30 percent is desirable or uses a bulk density of approximately 900 lb./yd^3.

In-channel

In-channel techniques primarily use a turning device that runs down a rail of some type. It is possible to have parallel bays with common walls so the turning device can be moved from bay to bay. This type system is expensive, but may be a better system for long term composting. The in-channel system may also be used in conjunction with an aerated system. Fans and air ducts are placed through out the system and will speed up the composting process by continuously providing oxygen in the compost mix. This may be of great benefit if the compost mix is highly volatile. Air from the fans can be discharged into a biofilter for odor control. A 30 percent porosity or a bulk density of approximately 900 lb./yd^3 will also assist in this process.

Quality Control

Thought must be given to the compost product use before developing the initial compost mix. The end product will be no better than the feedstock used to make the initial mix. Therefore, it

is very important to have a reasonably current nutrient analysis of each feedstock used in "recipe making".

A decision has to be made concerning end use and compost quality. If the compost is going to be used as a field manure source, the refinement or quality of feed-stocks does not have to be as great as that used in home landscaping.

To assist in determining if compost is cured, respiration rates of the compost can be determined by laboratory procedures. A field determination can be made by collecting a compost sample, saturating it with water (but not soaking, dripping wet), place in a sealed plastic bag and store in a warm place (70 - 85 F; 21 - 29 C) for one week. After one week open the bag, if there are no bad odors, the compost has stabilized.

Quality compost will have a C: N ratio of about 15:1. The time required to achieve quality compost will depend on the technique used to compost. It may take one year or more to achieve a quality compost using static piles, whereas, a quality compost may be achieved in 2-3 months using mechanical systems requiring a large capital investment depending on the size composting operation.

The final compost will be no better than the initial mix of feedstocks and the practices utilized during the process. Current nutrient analyses of the feedstocks are necessary in formulating the initial recipe mix. Refinement of feedstock quality of a compost mixture will be determined by its end use. In marketing compost, it must be of consistent quality.

Composting as a Mortality Treatment

Poultry mortality

Poultry mortality composting as a mortality treatment, as we know it today, was developed at the University of Maryland beginning in 1985. The major effort in 1985 was to support the Delmarva (Delaware, Maryland, Virginia) poultry industry. Procedures to process normal daily mortalities was the initial focus (Murphy and Carr, 1991). The concept rapidly spread throughout poultry producing states and many decision makers visited the Maryland research site. In 1995 an outside windrow catastrophic poultry mortality composting demonstration was conducted jointly between the Universities of Maryland and Delaware. The mortalities associated with this effort were not disease related, such as heat stress. The mortalities were composted very successfully (Carr et al., 1998). The avian influenza (AI) break in the Shenandoah Valley of Virginia in 2002 was of concern to the Delmarva poultry industry. A fact sheet was developed on in-house composting by the Universities of Maryland and Delaware (Tablante et al., 2002). The purpose of the fact sheet was to set guidelines for in-house composting in case AI paid a visit to Delmarva. There were industry concerns about parts of the fact sheet. To demonstrate to the industry that in-house composting was a viable option in case of an AI break, a full-house demonstration was conducted in 2003 to show the validity of the concept using processing plant dead on arrival (DOA) birds. The demonstration was very successful and a CD was developed (Tablante et al., 2003). In 2004 AI did visit Delmarva and all birds were composted in-house very successfully.

Large animal mortality

Large animal mortality composting resulted from the work with poultry. Today there is interest by emergency planners in the concepts of composting larger animals. There has been on going work in Ohio, Maryland, New York, Iowa and other states on large animal composting. Some states have also adopted this concept for highway road kills. For additional details refer to (Brodie and Carr, 1997 and Bonhotal et al., 2002).

Combustion

Combustion will be broken down into two categories. The first category will be methane production and the other will involve direct combustion of manure.

Methane production

Methane production occurs under anaerobic digestion conditions. The digestion occurs in two stages. The first stage is the acid forming stage. Acid forming bacteria convert volatile solids into acid. Stage two involves using the acids formed in the first stage to generate methane and carbon dioxide. Methane bacteria are slower growing than the acid formers. Therefore, pH is very important in the process. The desired range is 6.8-7.4 (Fulhage et al., 1993). There may be times when the pH will have to be adjusted. Lime has been used successfully for this purpose. Also, heat may have to be added to the system to maintain a 95 F (35 C) operating temperature. Manures high in nitrogen like poultry and swine may give problems with ammonia release because of the anaerobic conditions and must be monitored and corrective action taken as necessary. Table 2 shows the potential gas production for swine, dairy, poultry and beef. The data shows roughly 1/3 of the energy produced is used to maintain the digester temperature. Table 3 is a comparison of some typical farm heat requirements and the number of animals needed to meet these requirements. Loading rates, detention time and digester volumes for swine, dairy, poultry and beef are shown in Table 4.

Table 2. Potential gas production of swine, dairy, poultry and beef.

	Swine (150 lbs.)	Dairy (1,200 lbs.)	Poultry (4 lb. bird)	Beef (1,000 lbs.)
Gas yield, cu. ft. per lb. volatile solids destroyed	12	7.7	8.6	15
Volatile solids voided, lb./day	0.7	9.5	0.044	5
Percent reduction of volatile solids	49	31	56	41
Potential gas production cu. ft. per animal unit per day	4.1	22.7	0.21	31
Energy production Btu/hr/animal	103	568	5.25	775
Available energy Btu/hr (after heating digester)	70	380	3.5	520

Source: Fulhage et al., 1993

With the current petroleum prices alternate uses of manure for methane production becomes more feasible. Many methane digesters' in the past were not feasible because of low petroleum prices (Brodie, 1994b). Continuous use of the gas as generated is desirable because of storage limitations. One of the continuous operating systems for the past 20+ years has been the Mason-Dixon Dairy Farm in Pennsylvania, which uses the biogas/methane produced from digestion of dairy cattle manure to generate electricity. The electricity not used in the farm operation is sold to the electrical grid. The Great Lakes Regional Biomass Energy Program (http://www.cglg.org) is promoting the use of anaerobic digestion to produce energy. There are 19 farms as of June 2002 involved with this effort. Most use plug flow digesters' and some covered lagoons to produce the biogas. Most of the operations are dairy but there are some

swine and duck operations associated with this effort. Dairies range in size from 500 to 3,750 dairy animals. The capital cost associated with medium to very large size dairy operations range from $400 to $500 per animal. Small operations can cost up to $1,200 per animal (Kramer, 2002). Therefore, the cost of anaerobic digestion is not cheap. Stripping and utilizing the methane from the manure is positive for the environment because methane is a greenhouse gas.

The Inland Empire Utilities Agency, San Bernardino County, California, announces, "Renewable Energy Credits' generated through Cow Power". According to the Technical Director of the Renewable Energy Program at the California Energy Commission, California has a goal of over 20% of its power coming from renewable energy sources by 2010 (De Michele, 2004). This effort and those of the Great Lakes Regional Biomass Program are current operating examples of green power and what can be done with proper incentives. The Great Lakes Regional Biomass Agricultural Biomass Casebook is a good document to review if you have interest in methane/biogas production.

Nutrients from the digesters' are not diminished in the generation of biogas. Therefore, a comprehensive waste management plan is necessary to utilize the nutrients and the slurry mix as it is discharged from the digester. Some operations have sufficient land to apply the discharged material, while others may want to process the slurry mix through a squeezing device to separate the solids and the liquids. The liquids could go to a lagoon for further treatment and the solids to land application or composting.

Table 3. A comparison of some typical farm heat requirements and the numbers of animals needed to meet these requirements.

	Heat requirement (Btu/hr)	Swine (150 lbs.)	Dairy (1,200 lbs.)	Poultry (4 lb. bird)	Beef (1,000 lbs.)
Kitchen range (1)	65,000	77	14	1,547	11
Water heater (2)	45,000	107	20	2,143	15
Refrigerator (3)	3,000	22	4	429	3
Heat 1,500 sq. ft. home (4)	37,500	535	99	10,714	72
In-bin grain drying heater (5)	2 million	14,285	2,631	285,714	1,923
50 hp tractor operating at full load (6)	637,000	4,550	838	91,000	612

1 Assumed to operate 2 hrs/day, i.e., 24-hour average of 5,417 Btu/hr
2 Assumed to operate 4 hrs/day, 24-hour average = 7,500 Btu/hr
3 Assumed to operate 12 hrs/day, 24-hr average = 1,500 Btu/hr
4 Assumed 25 Btu/hr/sq. ft. heat requirement
5 Assumed to operate 12 hrs/day during drying season, 24-hr average =1 million Btu/hr
6 Assumed to operate 12 hrs/day, 24-hr average = 318,500 Btu/hr
Source: Fulhage et al., 1993

Table 4. Loading rates, detention time and digester volumes for swine, dairy poultry and beef.

Loading rate, lbs volatile solids per cu. ft. digester volume per day:			
Swine: 0.14	Dairy: 0.37	Poultry: 0.12	Beef: 0.37
Detention time, days:			
Swine: 12.5	Dairy: 17.5	Poultry: 10	Beef: 12.5
Digester volumes, cu. ft./animal:			
Swine: 5	Dairy: 26	Poultry: 0.37	Beef: 13.5
Digester volume for a typical livestock operation cu. ft./gal:			
Swine (500 head):	Dairy (75 head):	Poultry (15,000 birds):	Beef (300 head)
2,500/20,000	1,950/15,000	5,550/42,000	4,050/30,400

Source: Fulhage et al., 1993

Direct Combustion

Direct Combustion of manure is normally associated with three combustion processes: gasification; fluidized-bed, and stoker. Manure with less moisture is more desirable than that with high moisture content. Broiler litter would be suitable for direct combustion more so than cattle manure because of its high moisture content. Table 5 shows the effect of moisture on the combustibility of poultry litter. Higher moisture produced less BTU's in the litter. There was a tendency for the BTU's to increase as the density of the product increased from loose to pellet. These data show the BTU value of broiler litter to be about one half the value of coal.

As of 2002, no farm size units were available to burn poultry litter at the source of origin. However, several efforts are on the way for 2004, mostly supported by the U.S. Department of Energy Funds (Wimberly, 2002). According to Wimberly, for a commercial system to be successful it must be technically viable, economically feasible and user friendly to include trouble free manure handling. The system will have to meet government regulations concerning emissions and other environmental concern. On the other hand, larger centralized systems are being developed to generate electricity from poultry manures/litter.

Organic Fertilizer Manufacturing

With the poultry litter issues facing Delmarva in the late 1990's, one of the poultry companies partnered with a Mid-West group in the construction of a poultry litter pelletizing plant. The purpose of the plant is to produce a pellet easily shipped by rail car and applied in various farming applications. A manufacturing facility was built in Harrisonburg, VA to produce a value added granular fertilizer manufactured from litter. Another facility was built on Delmarva to manufacture fuel pellets from litter. These are just examples of some litter processing facilities in the United States. These processes drastically increase the density of the litter from the loose state. This is good for transportation and utilization of products whether it be in agriculture or combustion applications.

Table 5. Energy Values For Broiler Litter

Litter Condition	Range-Percent Moisture	Energy Value BTU/pound
Loose	10 - 20	5634 $\pm$ 1045
Loose	20 - 30	5440 $\pm$ 1003
Loose	80+	3200 $\pm$ 337
Ground	10 - 20	5802 $\pm$ 490
Ground	20 - 30	5317 $\pm$ 979
Pellet	10 - 20	6030 $\pm$ 976
Pellet	20 - 30	5782 + 641

Source: UMD Unpublished Data.

Summary

In this paper we have discussed some of the alternative uses for animal manures, to include composting, combustion and organic fertilizer manufacturing. The capital investment in any of these processes will be high. Markets for end products maybe the limiting factors in your decision to make the capital investment.

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Effects of Insufficient Air Quality Data on Regulatory Policy in Animal Agriculture

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General background

Public concerns related to air quality impacts from intensive dairy operations have grown considerably in recent years. Pollutants of concern include particulate matter (PM), volatile organic compounds (VOC), ammonia, methane, hydrogen sulfide, and odors. While public concerns translate into legislative and regulatory action, however, there is insufficient data on character, amount, dispersion, and mitigation of dairy air pollutants. Using California case studies, the present paper shows how the lack of science in both air emission estimates and mitigation can lead to dramatic effects on animal agriculture without improving air quality.

Emission factors

Emission factors are generally used to describe the emissions released to the ambient air from a specific production and/or animal type (e.g., dairy, beef feedlot). Despite dramatic knowledge gaps, the Environmental Protection Agency (EPA), State regulatory agencies, and local air quality agencies are mandated to use "best available" emission factor data for their emission inventories. The following case study illustrates how flawed and scientifically unsupported emission factors can be.

A case study in dairy air emission estimates: Volatile Organic Gases

California is the nation's greatest milk-producing state. Unfortunately, it is also home to two of the three worst air-sheds with respect to ozone pollution. One important ozone precursor group is called volatile organic compound (VOC). Current scientific information on dairy air emissions is very limited and excludes studies on VOC emissions from dairies. In the absence of this data, the air regulatory agencies in California use an obscure emission factor for dairy VOCs. This emission factor has already led to far-reaching regulatory action in the area of dairy permitting and could lead to the mandatory use of best available control methods (e.g., manure digesters, aerators) for newly constructed or expending dairies.

Considering the dearth of VOC emission studies that include dairies, the question arises as to how the current VOC emission factor developed. The data used to support the current VOC emission factor (Table 1) derives from a metabolism study conducted by Ritzman and Benedict (1938). This study measured methane (not VOC) emissions as part of metabolism studies in several ruminant species. The authors used a climate chamber, in which they tested methane emissions from an elephant, a horse, 12 cows, some goats, and sheep. The 12 cows that were used were different breeds (seven Holsteins, four Jerseys, and one Hereford). The material and methods section omitted feeding, animal age, sex, climatic conditions, experimental design, and statistical analyses that the scientists used. It is very unlikely that this study would pass the modern peer review process. However, omitted information aside, it is important to note that methane, and not VOC, was measured.

Over the years, the emission number of 160 lb/cow that was calculated from the Ritzman and Benedict (1938) paper was cited in six literature reviews. In 1978, however, Taback cited this 160 lb number incorrectly as Total Organic Gas (TOG) instead of methane. This incorrect TOG

number was later used by air quality regulators to calculate the current VOC emission factor of 12.8 lb/cow/yr (assuming that 8% of TOG equals VOC).

Table 1: California emission factor for VOC. The current California emission factor for dairy VOC of 12.8 lb/cow/yr developed as follows: The Ritzman and Benedict (1938) study provided a methane production number of 200 gram/d/cow. This number equals approx. 160 lb/yr. In 1978, Taback (1978) cited this methane number *incorrectly* as total organic gas (TOG) emission. Regulatory agencies later used this incorrect dairy TOG number and assumed that 8% of TOG equals VOC. Therefore, it was determined that 8% of 160 lb/cow/yr equals 12.8 lb/cow/yr, which is the current emission factor for VOC in California.

Source	Year	Type	Methane	TOG	VOC
Ritzman, Benedict	1938	Experiment	160		
Hutchinson	1948	Lit Review	160		
Ehalt	1974	Lit Review	160		
Keller	1977	Lit Review	160		
Taback	1978	Lit Review		160	
Halberg	1984	Lit Review		160	
Dickson	1988	Lit Review		160	
SJVAPCD	1997	Lit Review		160	12.8

It must be concluded that the VOC emission factor that determines dairy emissions today is derived from a study that is not only critically outdated but that did not measure VOCs at all. In summary, VOCs were never measured in quantitative dairy cow emission research. Despite the erroneous derivation of this emission factor, this number is used by regulators in California to determine who requires an air permit for their operations. Moreover, proposed mitigation methods are now evaluated for their effectiveness based on this same number. Scientists believe it is contrary to any stakeholder's benefit to employ a VOC emission factor derived from the 1938 study. However, it is equally impractical from a regulatory point of view to have no emission standards at a time when air quality is of intense public concern. Therefore, air emission researchers in California are under increasing pressure to provide scientifically defensible data that will support the establishment of a revised, accurate VOC emission factor.

Emission mitigation

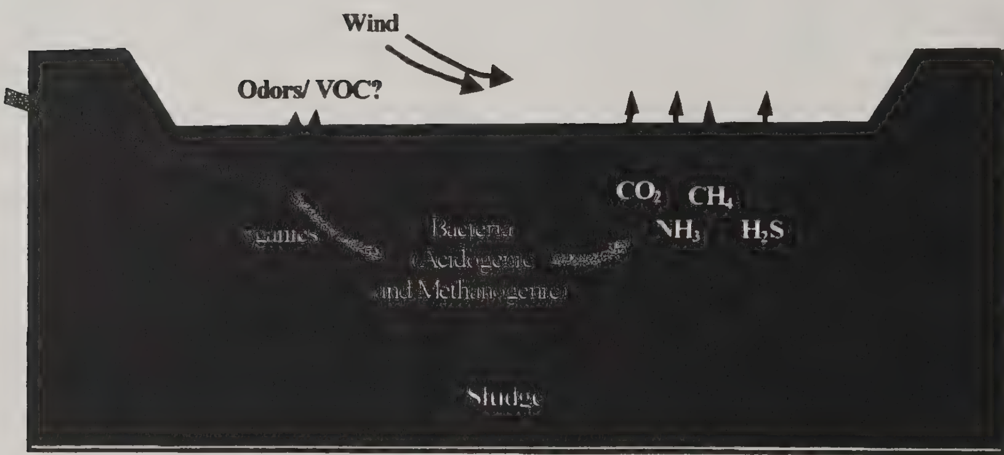
Although scientific information is scarce, the U.S. Department of Agriculture (USDA) is mandated to support farmers with data-driven emission mitigation techniques and technologies. New legislation – largely based on the flawed emission estimates discussed above – requires dairy producers to reduce emissions using "best available control methods", for which the National Research Council (NRC, 2003) has stated that intensive research is still needed.

The most pressing question with regard to air quality for the dairy producer is how emissions from the dairy can be reduced. Manure storage and treatment facilities are the main air emission sources on a dairy. Manure storage and management affect the physical, chemical, and biological properties of manure nutrients and consequently impact ammonia and VOC emissions. Once excreted, manure undergoes aerobic or anaerobic decomposition processes that generate different air emission profiles. Anaerobic digesters and aerators are most frequently cited as promising manure handling and treatment technologies. Both these technologies are strongly promoted by the regulatory agencies in California. The following case study sheds light on the effectiveness of aerators on air emission reduction and nutrient cycling.

A case study in air emission mitigation: do dairy lagoon aerators aerate?

The problem

Most dairies (64.5 %) in the Western United States use open-pit anaerobic lagoons for liquid manure storage (USDA, 1996). Anaerobic lagoons favor growth of methane-producing and



$$\text{Organics (CHONS)} \xrightarrow{\text{Bacteria}} CH_4 + CO_2 + H_2S + NH_4 + H_2O$$

Figure 1: Open pit liquid storage lagoon and potential air emissions: methane (CH_4), hydrogen sulfide (H_2S), ammonia (NH_4^+), and odors/Volatile Organic Compounds (VOC) (Zhang, 2003, modified).

sulfur-reducing bacteria that cause carbon, sulfur, and nitrogen from the cow waste to be partially released into the atmosphere in the form of methane (CH_4), carbon dioxide (CO_2), hydrogen sulfide (H_2S), and ammonia (NH_3), respectively. Anaerobic lagoons also release odorous compounds such as volatile fatty acids (VFAs), phenols, volatile amines, as well as volatile sulfur-containing compounds (Zhu, 2000). The levels of production of these compounds depend on the biological and chemical conditions in the lagoon.

The proposed "solution"

Considering reduction of air emissions to be an important objective in their liquid manure management plan, an increasing number of dairymen examine aeration (oxygenation) as a potential means of mitigation. Aeration is widely promoted (especially by regulatory agencies) and in some counties even mandated as an air emission mitigation technique to control methane, hydrogen sulfide, ammonia, volatile organic gases and odors released from dairy lagoons. The concept of aeration is not new, because aerators have been used in human waste treatment facilities since the 1960's (Cumby, 1987) with the goal of increasing oxygenation to change the type of microbial decomposition from anaerobic to aerobic. One

main aeration type works on the basis of *mechanical aeration* (mixing, circulation). This method uses float-mounted aerators that cause either down-draft or up-draft wastewater movement and dispersion. Circulated wastewater makes contact with ambient air introducing oxygen into the system (Rumberg *et al.*, 2004).

How does aeration work?

Aeration introduces oxygen to encourage aerobic bacterial growth and discourage anaerobic bacterial growth. The main anaerobic bacteria that work in anaerobic lagoons are hydrolytic and acidogenic bacteria, methane-producing bacteria, and sulfur-reducing bacteria. In heavily loaded lagoons, the hydrolytic and acidogenic bacteria are more predominant than methane producing bacteria, allowing accumulation of organic acids, amino acids, aldehydes, sulfides and other volatile compounds in the lagoon water. These accumulations result in high emissions of volatile organic compounds and odors. In lightly loaded lagoons, the methanogenic bacteria are able to thrive and consume the organic acids and lower the hydrogen potential of lagoon water so that the degradation of organic matter is more complete. This technique results in low emissions of volatile, odorous compounds. However, high emissions of methane can be expected from such lagoons.

Effective aerobic treatment systems should inhibit these anaerobic bacteria, reducing related emissions. It has been reported however, that even mechanically "aerated" lagoons show high concentrations of anaerobic, purple-sulfur bacteria that result in red discoloration of lagoon water (McGarvey, personal communication). This result could indicate that wastewater circulation and/or mixing, rather than sufficient oxygenation/aeration, is occurring.

Nutrient cycling

In theory, high rates of aeration will affect nitrogen cycling (reducing ammonia losses to the atmosphere). Nitrogen in anaerobic lagoons is generally found in the form of ammonium (NH_4^+) and organic nitrogen (i.e., protein, amino acids, bacterial protein). Very little nitrate (NO_3^-) if any, is present in anaerobic lagoons. At oxygenation rates sufficient to create a high concentration of dissolved oxygen (DO), ammonium is oxidized by nitrifying bacteria into nitrite and nitrate, a process referred to as nitrification (Maine DEP, 2003). For nitrification to occur, a lagoon pH of 7 to 8 is required, and oxygenation must achieve at least 2 mg DO/liter. Preliminary (unpublished) data obtained at aerated dairy lagoons by UC Davis Cooperative Extension personnel in the Central Valley of California and by Rumberg *et al.* (2004) at Washington State indicate that most aerator systems provide insufficient oxygenation levels (below 1 mg DO/liter lagoon water, low redox potentials) to the lagoon to promote growth of nitrifying bacterial populations. Therefore, nitrogen largely remains in its ammonium and organic nitrogen (rather than nitrate) form even in aerated lagoons (Rumberg *et al.*, 2004). Nitrification requires high oxygenation rates that could raise questions of economic feasibility with regard to aerators. Aside from the potential effects of (high) aeration levels on nitrogen compounds, aeration has not been reported in the scientific literature as significantly affecting other areas of nutrient cycling. Claims made by aerator manufacturers stating that aeration significantly affects nutrient cycling have yet to be substantiated in scientific studies and reported in the scientific literature. Preliminary (unpublished) tests conducted by UC Davis Cooperative Extension personnel showed no significant differences of aerated versus non-aerated commercial lagoons with respect to nutrient composition and dissolved oxygen concentrations.

Summary

To evaluate the merit of the currently used emission factors, the National Research Council (NRC, 2003) was appointed to review the scientific basis for current emission estimates. A major finding of the final NRC (2003) report was that current emission factors are largely inappropriate. While factors acceptable to NRC (2003) must be based on representative surveys from a class of operations (e.g., dairies) over several seasons, the current factors are

derived from predominantly grab-sample measurements conducted on one operation at one time. The committee recommended replacing the current emission factor approach with the use of process-based modeling using nutritional mass-balance approaches. The case of the California VOC emission factor has potential to negatively affect the entire California dairy industry. In the South Coast air-shed of California, the regulators intend to reduce dairy VOC emissions (that are calculated based on the 1938 number) by 30%, a goal that can only be achieved by relocation of a significant numbers of dairies out of the region. In the San Joaquin Valley of California, dairies are permitted based on this flawed VOC number and "best available control methods" to control VOCs – also measured against this flawed standard – are being mandated for new or expanding dairies. Furthermore, based on the current VOC emission factor, estimates by air quality regulatory agencies conclude that dairy operations are significant contributors to VOC emissions, and that cows will overtake cars as VOC producers in the near future. It is important to state that these serious claims are not based on scientific studies of VOCs on dairies, but on methane data from a climate chamber study that was conducted in 1938.

The second example of how a lack of science affects livestock agriculture without improving air quality is in the area of emission mitigation. Aerators are marketed to the dairy industry for the purpose of reducing or eliminating air emissions and nuisance odors. There is currently insufficient scientific evidence to support the claim that aerators generate the level of oxygenation necessary to achieve appreciable improvements in dairy air quality. Consequently, the accuracy of claims regarding the positive impact aerators have on nutrient cycling is also uncertain. Preliminary findings suggest that in order to achieve a reduction in dairy air emissions and to impact nutrient cycling, optimal oxygenation of dairy liquid manure may require dissolved oxygen levels higher than those achievable in an economically feasible manner with most currently available aerators.

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Water Quantity Concerns---Are they Real? What Needs to be Done?

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Animal Agriculture and Water Quality in Oklahoma

Oklahoma's livestock industry is constantly changing, but it has always been an important part of the state's economy. Beef cattle, swine, and poultry are the major types of livestock production in the state. In Fiscal Year 2003, 325 concentrated animal feeding operations (CAFOs) were licensed with the state. Of those, 229 were swine facilities. More than half of those swine facilities confine more than 2,500 head of swine weighing more than 55 lbs or more than 10,000 head of swine weighing less than 55 lbs. The remainder of the CAFOs in Oklahoma are made up of 16 dairy operations, 67 cattle operations, and 13 liquid waste poultry operations. In addition, 899 dry waste poultry operations are registered with the state.

Oklahoma experienced significant growth in the swine industry during the 1990s. In 1991, Oklahoma ranked 28th in the US in swine production. Today, they are ranked 8th. The dramatic increase in swine production in Oklahoma resulted in significant public interest in these operations. Traditionally, the state was a cattle and wheat state. The swine operations were different. The change in landscape upset many longtime Oklahoma residents in the vicinity of the swine operations. For some, the issue was odor, others were concerned about water usage and water quality.

The Oklahoma poultry industry experienced a more gradual growth over the course of the last 20 years. However, in 1997, the Oklahoma Conservation Commission (OCC) published a report indicating that several lakes used by the City of Tulsa as water supplies were eutrophic due to excessive phosphorus, causing taste and odor problems. In speculating about the causes of the excessive phosphorus, the OCC indicated that the increase in poultry operations in the watershed was the only changed condition, and therefore were more likely than not to be the cause.

Reactions to Water Quality Concerns

The public interest in the potential water quality issues for these types of sites reached a pinnacle in 1997 and 1998. Prodded by that public interest, the Oklahoma Legislature approved a bill in the spring of 1997 that substantially reworked the laws in the state relating to licensing of CAFOs. In April of 1997, the Governor convened the Animal Waste and Water Quality Protection Task Force. The recommendations from the task force were released in December of 1997 and called for additional revisions to the state's CAFO laws, as well as advocating new legislation to regulate the poultry industry. The 1998 Oklahoma Legislature approved two bills that followed many of the Task Force's recommendations.

Producers reacted to the constantly changing laws with anger and confusion. First, the laws changed dramatically several times over a relatively short period of time, leaving producers confused about what they needed to comply with on a day to day basis. Second, the laws created new burdens. For swine producers, the laws added new fees, requirements for monitoring wells, and mandatory education courses. Poultry producers were not previously regulated in the state, and now they had to comply with recordkeeping requirements, mandatory animal waste management plans based on phosphorus, annual inspections, and registration of their operation with the state.

Despite these changes, the industry responded with an intent to comply with all of it. Most producers, while unhappy about the changes, made every effort to get their operations in line with the new laws, and they continue to do so.

Future of Animal Agriculture and Water Quality

Water quality concerns are real issues to be dealt with by animal agriculture. However, water quality problems are not the norm for most operators. While the state has experienced surface water issues related to poultry operations and some groundwater issues related to swine operations, these impacts are not widespread. The industry will continue to experience growing pains, but new technologies are gradually becoming more economically feasible that will enable producers to adjust to future changes in the industry.

Encroachment, the Impact on Historically Agricultural Areas, and the Role of Extension

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From the late nineteenth century through the mid-twentieth century, the United States experienced an increase in land used for agricultural production - reaching the historical high in the 1950s. However, by 1997 land in agricultural production had significantly decreased (U.S. Department of Agriculture 1999). This loss of agricultural land is generally believed to be the cost of urban deconcentration and conversion of fields and pastures to residential and commercial areas for expanding urban areas (Jackson-Smith, 2003; Heimlich and Anderson, 2001). It seems to many that we have moved from a landscape of identifiable metropolitan concentrations to dispersed and deconcentrated development where differences between urban and rural are increasingly blurred (Palen, 1997).

The term sprawl entered the lexicon of the American public in the last two decades, referring in the popular sense to the visible expansion of residential, retail, business, and industrial development from earlier established urban and suburban communities to outlying and fringe regions of metropolitan areas. These development patterns are actually the most recent phase of the expanding American city that began in the early 1800s, but have accelerated in terms of speed and spatial scale with each decade (Hayden, 2003). While urban sprawl became the focus in the 1970s and 80s, rural sprawl accelerated in the 1990s. Development of housing on large lots in unincorporated areas, most often taking land out of agricultural production, is a growing phenomenon that must be included in any discussion of encroachment in historically agricultural areas.

As early as the 1950s it was suggested that the "rural-urban continuum" no longer lacked any real validity in practical application (Duncan, 1957). And while it seems the most recent pattern of urbanization is an unstoppable or inevitable pattern of development (Flora, et al., 2004), or a predictable, organic process (Heimlich and Anderson, 2001), academics and citizenry alike are beginning to ask if there are limits to this growth.

There have been recent examinations of current patterns of development (identified as sprawl and encroachment) identifying causes, impacts, and public policy responses (see Jackson-Smith, 2003; Heimlich and Anderson, 2001; Daniels, 1999; and Olson and Lyson, 1999). While these examinations survey the topic and discuss public policy responses, what is missing is an expanded discussion of the social dimensions of changing development patterns, including individual and community interpretations of the situation. This paper attempts to take the discussion in that direction, providing an overview of encroachment patterns and identifying the impact on people and communities in historically agricultural areas. It also explores the beliefs individuals and communities have regarding university extension and makes recommendations for strategies that historically agricultural areas can take to address issues of encroachment, including a role for university extension. This paper takes an intentional social focus rather than a public policy focus, noting that without community consensus and support, public policy and the actions of institutional representatives (such as university extension) are ineffective at best, and detrimental at worst.

In addition to the scholarly examinations reviewed, research experiences in Minnesota and Iowa over the past six years inform the recommendations made in this paper. Research methods used combine semi-structured interviews conducted between 1998 and 2001, roundtable discussions held in 2001, and review of historical and legal documents. Also reviewed were

more than 900 editions of local newspapers from 1990 and 2000. Research participants included extension educators, feedlot officers, planning and zoning officials, agricultural producers, community leaders, agricultural specialists, community activists, county and township officials, clergy, institutional and state agency representatives, non-farming neighbors of agriculture producers, and other community members. The examination encompasses three separate research endeavors completed by the author working alone and with others in seven different locations ranging from northern Minnesota to central Iowa. Part of the research was completed in conjunction with a study of social and community impacts of animal agriculture, a component of the Generic Environmental Impact Statement on Animal Agriculture completed for the Minnesota Environmental Quality Board by the North Central Regional Center for Rural Development at Iowa State University.

Encroachment in the United States – Urban and Otherwise

The expansion of urban areas began in the United States in the early 1800s. The history of what is often called sprawl has gone in stages since that time that have had different characteristics, and affected different populations (see Hayden, 2003 for a comprehensive review of this history that is summarized here). In the 1820s we saw the first construction in the borderlands between cities and rural areas. These were residences of middle-class urbanites escaping the high density of the city to live one or two miles outside of town. In the mid-1800s these middle-class residents began building enclaves of homes. Their residency was simplified by the development of streetcars and streetcar lines that began running to these buildouts around 1870. They were clearly not in the country - nor were they urban. This was a borderland between rural and urban (Hayden, 2003).

The first planned suburb was developed in 1869 (Williams, 2000) and by the 1930s, every American city had suburbs (Hayden, 2003). But these suburbs were different from the earlier picturesque retreats - they were suburbs of working-class families who wanted to escape the industrial urban centers. Pre-cut houses delivered by mail-order companies became the affordable way to fulfill the American Dream. Post World War II saw another escalation of suburban development, including the well-known housing tracts produced by the Levitts. By the 1960s we saw another ring of development known as edge nodes, and development beyond edge nodes into the rural fringe became evident in the 1980s and accelerated in the 1990s (Hayden, 2003). Although approximately 80 percent of Americans currently live in a metropolitan area, more than 60 percent of metro area residents reside outside of central cities and the highest rates of population growth are at the edges or urban areas (Williams, 2000).

While urban sprawl became a public concern in the 1970s and 80s, it was rural sprawl that accelerated in the 1990s. Most of this development is new housing built on large lots in unincorporated areas. While this is not a new phenomenon, it is growing. Between 1982 and 1997 more than 12 million hectares of land were developed or converted – and over half of this land was previously farmland (Natural Resources Conservation Service, 1999). Between 1994 and 1997 about 2 million acres of agricultural land were converted to residential uses, with 80 percent of these acreages located outside of urban or non-metropolitan areas (Peterson and Branagan, 2000, as cited in Heimlich and Anderson, 2001). People who live in these homes are both new to rural areas, and long-term rural residents who have moved from incorporated towns to large lots in unincorporated areas.

Rural housing developments are not of comparable size to urban or suburban building sites. More than 90 percent are over 1 acre in size and 55 percent of large lot development is in the largest lot size category – from 10-22 acres (Peterson and Branagan, 2000, as cited in Heimlich and Anderson, 2001). So while public concern and attention has been largely focused on urban sprawl, rural sprawl has its own significant impact on encroachment of agricultural land that cannot be disregarded.

The loss of farms and farmland and associated threats to productive cropland is the most often cited concern in terms of change in rural land use (Jackson-Smith, 2003). But this has not yet

equated to a threat to our food supply. While the number of acres in production has decreased over the past 50 years, rates of productivity have also increased, thus far resulting in a maintained level of production (Heimlich and Anderson, 2001).

When development creeps out and houses and other uses are interspersed with farmland, producers can adapt their operations (changing to smaller operations such as vegetable farms, greenhouses, or horse farms) or sell their land. It's also suggested that expanding metropolitan fringes have successfully accommodated agricultural production of both crops and livestock, although the intensity and production practices must be modified for this location, and 25 percent of our nation's agricultural production occurs in metropolitan counties (Daniels, 1998). Heimlich and Anderson (2001) point to several positive impacts for farmers in urbanizing areas. Off-farm income has become increasingly important to farm families, and proximity to urban areas means greater opportunities for off-farm household income. Access to a larger pool of part-time and seasonal labor is increased when the farm is located in or near an urban area. And growing populations can offer a growing market for high-value crops.

Loss of farmland takes place a little at a time, so it is not until after a great length of time, perhaps decades that a significant loss is recognized (Sorensen, et al.,1997). And farmland conversion happens at different rates in different areas of the country, placing areas with the highest quality farmland *and* the highest rates of conversion at the greatest risk (Olson and Olson, 1999). Another issue of encroachment is that farmland conversion is declining in efficiency. In 1982, we had .34 acre of built land per resident. With a population increase of 23 million from 1982 to 1992 we should have converted 7.8 million acres of farmland over the ten-year period to maintain our level of conversion efficiency, but instead we converted 14 million acres (Olson and Olson, 1999)

When urban or rural development spills over to historically agricultural areas, expanded services are required that are difficult to provide, as the local tax-base does not expand as rapidly as the needs of the expanding population. In addition, perceptions of adequate services may differ between long-term and newer residents in terms of neighborliness, tolerance for noise and odor, farm machinery on local roads, accumulation of machinery and vehicles around farm sites, and expectations of local schools and governments (Flora, et al., 2004). Increasing residential neighbors to farm operations can result in increased complaints regarding odors, noise, and chemicals (Heimlich and Anderson, 2001) and growing traffic can make farm operations more difficult (Williams, 2000).

Farmers indicate problems with trespassing, trash dumping, vandalism, and crop theft (Daniels, 2000). Markets and suppliers of agricultural inputs may dwindle as the number of producers is reduced (Heimlich and Anderson, 2001) and both farmland property values and property taxes increase as agricultural land is converted to non-agricultural purposes (Williams, 2000; Daniels, 1999). Environmental impacts include the introduction of lawn care chemicals and increased use of road salt to meet the demands of an increasing and auto-dependent population (Sorensen, et al., 1997). This increasing number of auto-dependent residents places increased demands on local roads and adds to air pollution (Daniels, 2000). And there can be an impact on community identity, as it becomes difficult to tell where one community ends and another begins (Heimlich and Anderson, 2001) and rapidly expanding populations make it difficult to socialize new residents to the community culture.

Attempts to curb both urban and rural encroachment patterns have increased since the 1970s, and while all states have some level of policies to preserve farmland, most approaches have been ineffective at the least, and harmful at the worst (Hayden, 2003; Nelson, 1992). Population movement seems to have outpaced planning and zoning efforts, and the result has been movement from "efficient by poorly maintained neighborhoods into alternatives that are not always carefully planned or well coordinated with other aspects of regional development" (Proscio, 2003). Nelson (1992) suggests that in some cases farmland preservation policies have actually encouraged hobby farms and low-density subdivisions. While not their intent, programs that provide property tax relief on farmland can distort or raise speculative land value.

Right to Farm laws can result in extended legal battles that producers cannot afford in terms of costs in time and energy. Transfer of development rights and purchase of development rights programs are expensive, and may only preserve open space for affluent property holders desiring a large estate rather than preserving productive farmland. And agricultural zoning can result in leapfrog development or purchase of large tracts of land by more affluent non-farmers.

Social Impacts of Encroachment in Historically Agricultural Areas

Clearly the research focus in the social sciences has been documenting conflicts occurring as a result of changing land use in historically agriculture-based rural areas, and less on ameliorative strategies. Moreover, while responses to encroachment have taken a decidedly public policy approach, there are community level social factors that must be considered. Dukes (1996) argues for more systematic application of public conflict resolution by policy makers to confront disintegration of community, alienation from government, and the inability to solve public disputes. This is an argument for building transformative practices of dispute resolution that inspire and nurture community. Others (Abdalla, et al., 2000) suggest successful resolution is based on "(1) the perception that any outcomes that are reached will be final and will be implemented by those involved, and the perception that all stakeholders' interests will be reflected in these outcomes (p. 33)." Additionally, procedural issues of civility and respect between stakeholders and increased dialogue influence stakeholders' perceptions of successful resolution. In other words, successful resolution from the perspective of community stakeholders is based in both process and outcome. Ultimately, the process must increase trust among stakeholders, decrease the sense of risk and uncertainty, increase perceived government fairness, and utilize public participation.

Community is a process of interaction between individuals within a place-based community, and we recognize that communities engage in both episodes of consensual and conflictual action (Luloff, 1990). But communities also maintain boundaries through conflict (Coser, 1956). Threats from an outside source increase internal cohesion, and when internal cohesion is high, there is an increased likelihood of community action. In this way, external threats can strengthen the group. Internal conflict also has the ability to strengthen the group and clarify group identity. However, when there is not interdependence, internal conflict has the potential to be divisive. "Interdependence checks basic cleavages (Coser, 1956, p. 76)", reducing the likelihood of polarized issues within a group

We have all noted the solitary farm site surrounded by a new housing development, fast food restaurants, or big-box retail stores as we drive through the urban fringe of our nation's cities and rural settlements along main artery roadways. There is even a cable television program that spotlights what are termed "holdouts" to urban expansion. These anecdotes point to the current situation for agricultural producers.

Farmers are disadvantageously impacted by the patterns of development discussed here due to their increasing minority status compared to non-farmers in both rural areas and the urban fringe. This is because of their relative inability to move their operations to another, more isolated location. Their ties to the land they own and the locality in which they have invested a lifetime of experiences are also strong, and are ties they are unwilling to break.

At the same time fewer people in our nation have ties to production agriculture, the public has an increased interest in and influence on agriculture operations (University of Minnesota, 2001). Different groups of local citizens interpret changes in agriculture and rural areas differently. Framing is a useful tool for examining how individuals and groups interpret situations, experiences, and events (Snow and Benford, 1992). Frames denote "schemata of interpretation" that allow individuals "to locate, perceive, identify, and label" things that occur in their lives and the larger world (Goffman, 1974, p. 21). Frames organize individual experiences and subsequently guide actions, both individual and collective. There are also times when there is dispute between frames as parties with opposing versions openly disagree over the definition

of what is taking place. Eventually one position will either convince or dominate the other (Goffman, 1974), but in the interim there is a period of frame dispute.

The research conducted in Minnesota and Iowa points to two dominant frames for interpreting changes in agriculture in historically agricultural areas, with frame dispute apparent in community controversies. The agribusiness frame views large-scale and confinement production practices as unstoppable trends in agriculture, and those farmers and farming families who want to be successful will proceed in this direction. This is viewed as their right, and regulation should not be enacted that will interfere, including planning and zoning that accommodates residential development. This frame is consistent with the conventional agriculture frame of Beus and Dunlap (1990). The quality of life frame views large-scale and confinement production as a threat to the local environment, family health and welfare, family farming, and a traditional way of rural life that must be preserved. This frame is clearly focused on private sphere issues, and takes action in personal and local ways to prevent or respond to livestock production facilities that are perceived as industrial or corporate. There are some connections here to the alternative agriculture frame of Beus and Dunlap (1990).

Patterns of encroachment by development in historically agricultural areas bring to fore questions of how we define agriculture-based communities. This is evident in the agribusiness and quality of life frames. Citizens who view rurality and the future of what they define as rural areas as one of multiple-uses are consistent with the quality of life frame. In contrast is the position that present and future rural development is based in high technology and intensive agriculture (Burmeister, 2000) which is consistent with the agribusiness frame. While these differences in perceived rural realities manifest themselves in local struggles, this reflects a broader political struggle over the future of rural areas in our country.

When we perceive encroachment in historically rural areas as having a primary impact on farming operations, we miss the significant impacts on rural communities and the environment (Hasse and Lathrop, 2003; Jackson-Smith, 2003). The historical basis of community economies in the rural United States has been natural resource extraction (e.g. farming, mining, and timber). While most rural economies are no longer dependent on natural resource extraction (Flora, et al., 2004), in many locations it is still a component of the local economy and a source of employment. More significantly, it is part of community identity and inherent in community belief structures (Salamon, 1995). But changing patterns of development can lead to frame dispute.

Margolis (1992) explored the nature of neighborly relationships and the boundary problem that exists with environmental elements that are "unbounded," like odor and sound. Because a person cannot inexpensively move from a neighborhood they view as being invaded by unpleasant noise or odor caused by a neighbor, conflict is a likely result. There is also a social element in the reported degree of annoyance (Lohr, 1996). Among neighbors of a swine farm there were three variables that negatively correlated with degree of odor annoyance: the length of time they had lived in their current residence, previous contact with the farmer, and their economic dependence on farming.

In addition to farmland loss and community changes, urban and rural encroachment in historically agricultural areas can also have environmental impacts (Jackson-Smith, 2003) that impact community identity and culture. Certainly agriculture producers have been pointed to as negatively impacting the environment in terms of water, soil, and air quality. However, emerging patterns of development in previously agricultural land bring new environmental challenges, including decreased wildlife habitat (Jackson-Smith, 2003), septic tank and lawn chemical impacts on groundwater quality (Daniels, 2000), and disruption of established ecosystems (Olson, 1999). There is also a loss of community space to enjoy the environment. Public access to waterways and undeveloped lands that are connected to community identity and formal and informal gatherings may be reduced or eliminated (Heimlich and Anderson, 2001). All of these environmental impacts can influence the social and cultural context in historically agricultural areas.

Role of Extension

Given the changes described here, what is the role of university extension in their work with producers and communities in historically agricultural areas? As communities have changed, so have the roles of university extension and local extension educators. However, a review of the literature suggests the roles of university extension may not have changed enough as perceived by those they are mandated to serve.

Individuals living in rural areas and not engaged in agriculture (the majority of rural residents) suggest they experience institutional neglect. The idea that farming interests, rural interests, and agriculture interests are identical is a flawed supposition that unfortunately is the assumption of many of our agriculture-oriented institutions (Swanson and Brown, 2003; Thomas and Howell, 2003). Universities and university extension have a part in this. While both Land Grant Universities and the Department of Agriculture are congressionally mandated to serve non-farm rural America, neither has historically directed substantial attention or resources in this area (Browne, 2001; Swanson and Freshwater, 1999). And with resources for our universities and institutions dwindling, it is not likely that limited funds will be stretched to include non-farming rural interests (Swanson and Brown, 2003).

There has also been criticism of university extension's relationship with agricultural producers. Gray, et al., (1997) point to the failure on the part of research and extension to identify and address the interests of farmers in an arena where power relations play out. They suggest the focus of scholarly literature in extension is transfer of knowledge to producers, with an assumption that increased education will result in understanding that farmer's interests are those identified by university extension. What is missing is beginning with an examination of farmer's interests, or research and extension practices that include examination of farmer interests. This requires adoption of a transparent pluralism on the part of institutions. "Neither social nor physical scientists can retreat behind the assumption that the products of their work will be socially neutral. They therefore have a responsibility to ensure that the interests they serve are not merely their own, and moreover, to safeguard against damage to the interests of other parties (p. 103)." It cannot be assumed that there will be convergence of the interests of individual, community, and capital.

Bachtel (1989) has sounded the alarm regarding the future of agricultural extension.

> First, the farm population has historically been a major portion of Extension's clientele base. While farming has and always will be a critically important enterprise, the number of people directly engaged in production agriculture will continue to decline. Thus, Extension's primary support group also will decrease. Second, the reduced farm population also affects Extension because, historically, a large portion of Extension's professionals have had farm backgrounds. The net effect of these trends is that Extension clientele and the traditional pool of potential workers will continue to decrease into the next century (p. 30).

Ultimately, the future of university extension will lie in hiring professionals from urban areas without agriculture backgrounds, with expertise in areas outside of agriculture, and serving other than farm clientele.

Six years of research completed by the author has also pointed to a general theme of perceived neglect from local and state agencies and institutions, including university extension. Institutions are viewed as responsible for perpetuating a hostile and inequitable community climate in rural areas. Both farming and non-farming residents are highly critical of local and state agencies such as local planning and zoning, state pollution control agencies, university extension, and county feedlot officers who are viewed as complicit in developing dysfunctional and arbitrary land use policies that more frequently exacerbate problems than solve them. In addition, the lack of responsiveness and responsibility of the state pollution control agency to mediate potential conflicts delegitimize the state as an effective authority, and encourages citizens to attempt to solve their problems through a variety of extra-legal means. Land grant

universities, and university extension as their representatives, are viewed as promoting changes in agriculture that support large scale production and intensive animal agriculture. This decreases their legitimacy with small farm operators and community members not affiliated with agriculture.

Recommendations

Swanson and Brown (2003) point to three important remedies for challenges confronting rural societies.

> (1) the recognition among government managers and academicians that experiences in local societies, in communities, is important; (2) the renewed emphasis on the rights and responsibilities of citizenship and civility in proactively addressing social problems and enhancing quality of life; and (3) the decentralization, or devolution, of authority for federal social and economic development programs to the states and their localities (p. 400).

These suggested remedies guide the recommendations made here.

Devolution of programs by federal government agencies has clearly placed greater emphasis on decision-making at the most local level - often the neighborhood or community (Swanson, 2001). It is also at this local level where residents feel they have the greatest influence in terms of participation and change (Marston and Towers, 1993). Innovative approaches that harness enhanced local jurisdiction over issues of encroachment rather than perceiving it as institutional neglect (Swanson and Brown, 2003), *and* include the involvement of local citizens, suggest the greatest promise. The pattern is not unstoppable - trends can be modified by communities, groups and individuals (Flora, et al., 2004).

We know that the most effective rural development is based in civic engagement, inclusiveness, civility, and democracy. Also required are social interactions that enhance local social capital (Swanson and Brown, 2003). When we endorse public policy solutions to issues associated with encroachment on farmland developed without local citizen involvement and a pluralistic approach, we are usually disappointed. While there have been some excellent materials developed to guide an integrated public policy process, they are either missing or include insufficient attention to the social aspects of civic engagement and inclusivity. A democratic and inclusive public planning process will support both civic engagement as citizenship, and sustainable development (Hayden, 2003).

So how do we respond to encroachment in historically agricultural areas? It is suggested here that a combination of two social elements are needed for individuals and communities to come together at the most local level to identify for themselves the direction development will take in their location. Public policy must come after and as a result of these social processes. What is proposed is a process of frame bridging and identification and encouragement of social preservation.

<u>Social Preservation</u>

In both urban and rural communities we find a set of social practices known as social preservation (Brown-Saracino, 2004). This is the desire of individuals to live in a central city or rural location in order to be part of an "authentic social space" that has the presence of what are perceived to be long-term or original residents. Social preservationists want to be part of this culture, and also work to preserve the community culture. This is very different than gentrification, where middle class residents move in to a poorer neighborhood (either urban or rural) in sufficient numbers to transform the social identity of the location. In gentrification the new residents often displace the old-timers, while social preservationists view long-time residents as desirable, necessary, and authentic. Social preservationists seek interaction with their neighbors, celebrations of community such as community festivals, and working-class families. They also have distaste for the modern community and the isolation of suburbs and affluent urban neighborhoods.

Why is this important for historically agriculture based areas? Because more than 20 percent of our citizens have chosen to live in an area that's rural. And the rural rebounds of the 1970s and 1990s showed us that this desire is increasing. Rural areas are perceived as cleaner, safer, and less expensive places to live compared with central cities and suburban areas. Home purchase prices are also perceived to be lower, an important factor when a house has become the primary investment for many families (Daniels, 2000). The preference for rural and small-town residence was an inherent part of the first suburban residential developments, and this preference continues to work in conjunction with the development push to the urban fringe and rural areas (Hayden, 2003).

Social preservationists new to rural areas will engage in action to prevent displacement of old-timers and disruption of community. They are generally well-educated, politically articulate, and not afraid to engage in political practices for preservationist purposes. They patronize established businesses, plan to stay in the community rather than seeking to sell their property at a profit, and desire friendly relationships with old-timers. They also recognize the impact their presence has on the community, including potential negative impact.

Social scientists, not unlike some long-term residents of historically agricultural areas, have confused social preservationists with gentrifiers. This is not only an error, it is a missed opportunity. Social preservationists seek to maintain the culture of the communities where they live. Long-term residents share this goal. But this also presents a problem. While social preservationists are seeking a culture based in agriculture, they have no individual experience of what that means. This presents an opportunity for frame bridging in historically agricultural communities.

Bridging Frames

Frames organize individual experiences and guide individual and collective action. A frame is an ongoing interactive ideology that performs three functions - identification of problems and cause, identification of tactics and strategies, and identification of the reasons for action. (Snow and Benford, 1988). In this case, different groups of local citizens interpret changes in historically agricultural areas differently, identifying the problem and cause, tactics and strategies, and the reasons for action based on their position.

One means of ending frame dispute is bridging the frames that are in dispute. In other words, finding commonalties in interpretation, and beginning the community planning with a holistic and inclusive approach at that point. This means recognizing that there is a point of agreement that can serve as a bridge between different frames. As previously discussed, research in Minnesota and Iowa points to two dominant frames in historically agricultural areas – agribusiness and quality of life. While these frames interpret the situation quite differently, it is interesting to note that preservation of family farming is part of both frames. Both groups feel strongly that family farms are an aspect of rural culture that must be preserved, and both groups identify farming as a source of community identity (although there is disagreement regarding the impact agriculture has on community economy). Interestingly, social preservationists who move to historically agricultural areas will also endorse family farming as a source of community identity. They have moved to the area *because* of the culture, a culture that includes the historical value of family farming.

We know that threats from the outside can increase community cohesion, and when internal cohesion is high, there is an increased likelihood of community action (Coser, 1956). Development pressures that encroach on historically agricultural areas can serve as a means of strengthening communities when frames are bridged between the agribusiness, quality of life, and social preservationist groups. In this way, the perceived external threats can strengthen the group. Internal conflict also has the ability to strengthen the group and clarify group identity. However, when there is not interdependence, internal conflict has the potential to be divisive. By bridging frames at the local level interdependence is increased, decreasing potential for future issues to turn divisive. When frames are effectively bridged we will see communities

work together to address issues of encroachment. Until that point, changes in rural areas will continue to lead to community division - periods of frame dispute – and effective approaches with broad-based community support that address issues of encroachment will not result.

Role of Extension in Social Preservation and Frame Bridging

There is a role for university extension in supporting a holistic planning process to identify interests that includes all stakeholders. In resolving local disputes, it is suggested that extension support a consensus-based process that addresses personal needs, interpersonal relationships, and acceptable products (Fiske, 1991). This is a process that requires extension staff with expertise in social issues, not just those involved in agriculture. (Gray, et al.,1997). To effectively support frame bridging in historically agricultural areas university extension must support and participate in the process that serves the interests of all stakeholders – not just those of the university or those of the agribusiness frame. Perpetuating the present level of divisiveness in rural areas will continue to divide communities and will do nothing to address issues of encroachment. This is the case when university extension acts as an agent of the agribusiness frame. However, as Bachtel (1989) suggests, the future of university extension includes specialists from outside of agriculture – work with communities will require increasing numbers of professionals who understand the dynamics of community and an inclusive, holistic approach.

Working together with a shared vision of the desired future condition, individuals as members of communities can influence the future. This includes the involvement of university extension, including specialists outside of agriculture, as supporters of a holistic, community-based decision making process rather than advocates for university or institutional interests. Rural residents should never be perceived as "passive consumers of broader national change" (Flora, et al., 2004, p. 17)." Rather, they should be looked to as directing the future of their communities if we have any hope of successfully controlling encroachment patterns in historically agricultural areas.

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Assimilation vs. Accumulation of Macro- and Micro-Nutrients in Soils: Relations to Livestock Feeding Operations[1], [2], [3]

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Summary

Nutrient management is an integral part of profitable agrisystems, but in some areas of the U.S. continued inputs of fertilizer and manure nutrients in excess of crop requirements have led to a buildup of nutrient concentrations that are of environmental concern. Proper use of nutrients in livestock manures is becoming more critical for sustainability of concentrated animal feeding operations (CAFO) because new environmental regulations require that nutrients be properly applied and managed. Most agronomic soil tests were developed to determine appropriate inorganic fertilizer application rates and must be used with caution when determining manure application rates.

Losses of nutrients such as nitrogen (N) and phosphorus (P) can be reduced by refining the rations fed, increasing nutrient retention by livestock, moving manures from areas of surplus to deficiency, finding alternative uses for manure, using cropping and haying systems that remove excess nutrients, and using conservation practices such as limited tillage, buffer strips and cover crops to limit runoff and leaching. Whole farm nutrient balances are useful for educating producers about quantities of nutrients being managed and the flow of nutrients, but they can also be misleading because of spatial factors such as uneven nutrient application that introduce environmental risk not noted with a whole-farm nutrient balance. Manure utilization plans also need to deal with nutrients that potentially leave the field or production area en route to sensitive ecosystems on or near the production unit.

Description of Problem

American livestock production has changed dramatically over the past three decades. As livestock and poultry production have become more spatially concentrated, the quantity of manure nutrients relative to the capacity of local farm land to assimilate those nutrients has grown, especially in high production areas (Kellogg et al., 2000). The number of counties in which the production of recoverable manure nutrients exceeds the assimilative capacity of the crop and pasture land in the county has increased dramatically since 1982 (Lander et al., 1998). Today at least 2 to 5 % of counties produce more manure than can be assimilated by total crop land and pasture in the county – mostly in North Carolina, the Chesapeake Bay area, Southeastern states, and California (Kellogg and Lander, 1999; Kellogg et al., 2000; Kellogg, 2000).

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Numerous studies have demonstrated that swine manure effluent, dairy manure, poultry litter, beef feedlot manure, and the compost of these manures can be valuable fertilizers on crops but that over-application can have detrimental effects on yield and soil properties. Excessive application of manure and fertilizer can lead to accumulation of nutrients in soils and to increased losses of N via volatilization, leaching, or runoff. (Legg and Meisinger, 1982: Figure 1 & 2). Today, there is an increased desire that agricultural operations be "sustainable." Thus, it is essential to maintain soil fertility and quality while minimizing any potential negative impacts on surrounding ecosystems. The objective of this manuscript is to briefly review current research that can be used to improve livestock manure utilization, while minimizing potential adverse effects on the environment.

New Nutrient Management Regulations

Until recently the major regulations regarding manure from animal feeding operations concerned the capture and control of runoff from pen areas and there were few regulations concerning the use of manure collected from CAFO's. However, with the advent of the new EPA Clean Water Regulations (EPA, 2003a, 2003b), proper use of manures to avoid contamination of surface and ground waters is required. All CAFO's, and many smaller animal feeding operations (AFO's), must have comprehensive nutrient management plans (CNMP) and manure nutrients must be applied to farm lands at no greater than agronomic rates – i.e., rates that do not over-supply nutrients to crops or other vegetation. Thus, meeting nutrient application standards may require AFO's to spread manure over a much larger land area than they currently use. Ribaudo (2003) reported that only 18% of large hog farms and 23% of large dairies currently apply manure on enough crop land to meet a N management plan. Lander et al. (1998) estimated that only 20 (P-basis) to 50% (N-basis) of AFO's operate with enough land to meet new land application requirements.

To meet new standards, the annual net income of livestock and poultry farms could be decreased by more than $1 billion (approximately 3%) annually. However, the actual outcome depends on the willingness of crop land and pasture land operators to substitute or replace commercial fertilizers with manure.

Manure as a Fertilizer

Mismanagement of manure when applied to crops or forages can result in runoff of nutrients or pathogens to surface waters, percolation of nutrients to ground waters, accumulation of nutrients in the soil, or loss of significant quantities of N and carbon ©) to the atmosphere. Many farmers prefer to use commercial inorganic fertilizers, rather than manure or litter because of factors such as uncertain and inconsistent nutrient content, difficulties in uniform spreading, soil compaction, odor, weed seeds, high salt content, personal opinions, and transportation costs. Increased paper work from regulations could potentially further decrease use of manures by farmers.

The composition of manures collected from CAFO's vary greatly depending upon animal species, the diet fed, length and type of storage, type of housing, timing and method of manure collection, pen surface, location in pen, bedding/litter used, application systems, etc. (Klausner et al., 1984: Choudhary et al., 1996: Table 1). Most field crops and forages require a N:P ratio ranging from 5:1 to 8:1. Because N may volatilize rapidly from manure as ammonia (NH3), nitrous oxide (N_2O) or N_2 gas, in general, the N:P ratio of manures is less than the N:P of the diet and less than required by most field crops or forages.

<u>Nutrient Conversions in the Soil</u>

Capacity of soils to accumulate nutrients Most soils have the capacity to bind nutrients in significant concentrations; nonetheless some nutrients can accumulate in soils to the point of becoming toxic to plants (Nelson, 1999) or may be sources of nutrients to neighboring ecosystems. Soils remove ions from the solution phase by adsorption, fixation, and surface

precipitation reactions. These mechanisms, collectively referred to as sorption, play a major role in regulating solution concentrations of nutrients and consequently their mobility and availability to plants. The bioavailability and mobility of nutrients in soils depends to a large extent on the soil's mineralogy and reactive surface area, the chemical and physical soil environment, and the amount and type of fertilizer applied.

Sorption mechanisms in soils include: 1) ion exchange - weak electrostatic interactions between charged colloids and counterions in solution, 2) fixation - specific adsorption whereby an ion is chemically coordinated to a surface functional group, and 3) diffusion of inorganic species into the solid phase. Cation exchange is a chief mechanism for the adsorption of alkali and alkaline earth metals, ammonium (NH_4^+), and some heavy metals. Most soils also contain a small amount of anion exchange capacity derived from Fe and Al oxides and edges of layer silicate clays. In highly weathered or volcanic soils, anion retention can significantly retard leaching losses of mobile solutes such as nitrate (Arora and Juo, 1982).

Specific adsorption of nutrients through ligand exchange on hydroxylated surface sites of oxides or edges of layer silicate clays is an important mechanism for the relatively high energy binding or "fixation" of oxyanions (e. g., phosphate, sulfate, selenite, arsenate, and organic acids). Heavy metals (e.g. cadmium, Cd; copper, Cu; lead, Pb; nickel, Ni; zinc, Zn) can also be strongly sorbed onto the surface of silicate clays. Decomposition products of manures (e.g. humic acids) may substantially increase sorption of these heavy metals by increasing the number of binding sites on humic-coated mineral surfaces at a low pH. Alternatively, at high pH, humic acids may form aqueous complexes with metals that have greater mobilities than non-complexed forms (Murphy and Zachara, 1995).

Precipitation and dissolution of minerals in soils are important thermodynamically driven processes that can influence the concentration of inorganic species in solution. In soil systems, precipitation of dissolved ions is greatly facilitated by the presence of mineral surfaces. In addition, precipitation and dissolution reactions are controlled by poorly crystalline (amorphous) mineral phases. These factors complicate the estimation of the soil solution concentrations of nutrients that are subject to transport.

Because many nutrients and trace elements in animal manures are organically bound or contained within structural components, their mobility and availability is not straightforward. For instance, nitrogenous compounds in manures require biologically mediated mineralization to inorganic forms (e.g. the conversion of urea and amino acids to ammonium) before they can be utilized by plants. Most soils have limited capacity to store N because soil N accumulates in association with C as soil organic matter which is maintained at a quasi steady-state condition depending on tillage practices, cropping systems, climate, etc. Nitrogen can be temporarily stored as nitrate but this readily soluble form can be rapidly leached below the root zone. Because N sources are only temporarily stored in soil, N additions are normally applied just before the active uptake stages of the crop. Much of the N in manures is in organic forms that are released more slowly than commercial inorganic fertilizers.

Reliable predictions concerning the mobility and bioavailability of nutrients and trace elements in soils is difficult because of the vast array of sorption processes, microbial processes, time scales of reactions, soil mineralogies, and the effects of competing anions, cations, and humic acids in the soil solution. Moreover, determining an environmentally acceptable retention capacity has been difficult because erosion potential and management effects add complexity in determining tolerable losses of soil P and other nutrients (Nelson, 1999). Nevertheless, regulatory agencies in many states are establishing upper limits for soil test P, some at levels only marginally above the crop response level but many at levels two to three times higher than crop response levels.

Nutrient availability and solubility The availability of manure nutrients to plants is highly variable and may be dependent upon the diet fed, environmental conditions, and soil mineralogy. In general, approximately 20 to 50% (less in semiarid, non irrigated regions) of manure N is

mineralized to plant available forms during the first year. Because most manure P is in the inorganic form (Robinson et al., 1995), 60 to 90% of manure P becomes available each year (Eghball and Power, 1999; Evers 2002). Manure potassium (K) is usually in a highly plant available form when excreted. Van Kessel and Reeves, (2002) reported that the availability of dairy manure organic N was highly variable and that the phytoavailability of N could not be predicted from simple compositional differences in dairy manures. Nitrogen mineralization rates of composted cattle manure have ranged from 5 to 34% per year with an average of 20% during the first 2 years 10% the third year and 5% per year for the next 9 years. (DeLuca and DeLuca, 1997). Using N and P mineralization rates they were able to develop a compost utilization rate for corn that would reach sustainable N and P utilization after approximately 12 years of applications.

There is limited information on the availability of other minerals in various manures. Based on chemical analyses, Eghball et al. (2002) estimated that plant availability of Ca and Mg in beef and swine manures was greater than 55%, whereas the plant availability of Zn, iron (Fe), manganese (Mn), Cu, and boron (B) in manure was less than 40%. Plant available sulfur (S) was 23% in swine manure and 50% in beef cattle manure. Kuo (1981) noted that nutrient transformations and plant uptake of Cu and Zn were more limited in poorly drained soils than well drained soils.

Phytotoxicity Manure and inorganic fertilizers can contain high concentrations of trace minerals that are potentially toxic to plants (Raven and Loeppert, 1997). Van der Watt, et al. (1994) noted that Cu, Zn, and Mn could potentially accumulate to phytotoxic levels in soils amended with poultry litter for long times. Data on speciation of arsenic (As) indicated that the relatively nontoxic supplemental form of As (ROX) used in many poultry feeds is converted to the more toxic As(V) and to unknown forms (Peryea and Kammereck, 1997; Jackson et al, 2003). However, commercial P fertilizers can also contain As and other heavy metals (Raven and Loeppert, 1997).

Effects on Other Soil Characteristics Several studies indicate that additions of swine and cattle manure to acid soils can increase soil pH (Whalen, et al., 2000; Chantigny, et al., 2004). This increase in pH could increase ammonia volatilization, alter N mineralization, and modify nutrient availability and solubility (Whalen et al., 2000). Some studies report that organic sources of P can modify the P sorption characteristics of soils and thus affect P movement (Siddique and Robinson, 2003). Thus, research on application of manures to soils needs to consider Ca, organic C, and other components of manure.

<u>Soil nutrient analyses</u>

Kamprath et al. (2000) noted that most soil tests were developed to determine proper application rates of synthetic fertilizers for fertilization needs; however, today we are attempting to use many of them to evaluate potential environmental hazards. Schwartz (unpublished data) determined that this may not be appropriate, especially when nutrients are provided by manure, rather than commercial fertilizer. There appear to be considerable differences in the water solubility of P in manures ranging from 25 to 30% in dairy manure, poultry manure, and swine slurry (Kleinman and Sharpley, 2003) to 6 to 13% in beef cattle manure and composted cattle manure (Sharpley et al., 1984; Eghball, 2003; Schwartz, unpublished data). Therefore, it is not surprising that soil test P using agronomic extractants is greater in soils fertilized with a soluble potassium phosphate than in soils fertilized with feedlot manure (Schwartz, unpublished data).

Effects of dietary factors Sorenson and Fernandez (2003) noted that the fiber r = -0.73) and crude protein r =0.53) content of swine diets affected the subsequent mineral fertilizer equivalent value of slurry N. Similarly, Sorenson et al. (2003) noted that the dietary crude protein r = 0.71) and crude fiber r = -0.73 to -0.82) content of dairy cattle diets were correlated to the subsequent mineral fertilizer equivalent value of slurry N. The plant availability of slurry N was correlated with the ammonium content ($r^2 = 0.53$) and negatively correlated to the slurry C:N ratio ($r^2 = 0.67$) and dry matter:N ratio ($r^2 = 0.58$).

Ebeling et al. (2002) noted that excessive addition of inorganic P to dairy diets (0.31 vs. 0.49%) produced manures with higher P concentrations (0.48 vs. 1.28% P). When applied at equal N application rates, total P runoff was 6 times greater and dissolved reactive P runoff was 10 times greater for the high-P manure than the low-P manure. When applied at equivalent P levels, total P runoff was 2 times greater and dissolved reactive P runoff was 6 times greater for the high-P than low-P manure.

Effects of composting Composting CAFO manure, either alone or with other agricultural or industrial byproducts, has been proposed as one method to improve the utilization of manure. Composting animal manures has a number of agronomic benefits including a decrease in application cost, decrease in mass and water content, pathogen suppression, destruction of weed seeds and feed additives, smaller and more uniform particle size, and decreased odor emissions. However, composting significantly alters the nutrient composition of manures. In general, during composting there is a 30 to 50% decrease in mass due to losses of C (46 to 62% loss) and N (19 to 42% loss) (DeLuca and DeLuca, 1997; Eghball et al., 1997; Loecke et al., 2004a). This decreases the N:P ratio and increases the concentration of other nutrients. The effects of composting on nutrient volatilization, nutrient leaching, and nutrient concentration can be affected by many factors including moisture content, C:N ratio, frequency of turning, days of composting, and temperature (Eghball et al., 1997: Parkinson et al., 2004).

Field studies comparing fresh vs. composted dairy (Brinton, 1985; Ma et al., 1999) and feedlot manure (Eghball and Power, 1999) reported no additional effect on corn yields. Cooperband et al (2002) reported 25% lower corn yields with composted poultry litter than noncomposted litter when applied on an equal N basis. In contrast, Loecke et al (2004a, 2004b) noted that corn grain yields were 10 to 15% greater when composted swine manure (from deep bedded hoop structures) was used in contrast to freshly scraped manure; in part due to a greater N fertilizer equivalency (compared to urea) for composted rather than raw swine manure. Because of these and other contradictory reports, it is not possible to clearly determine the impacts of composting on crop performance, soil quality, environmental concerns, and nutrient assimilation and accumulation.

Nutrients in lagoons and retention ponds Depending upon the type of housing and manure handling system, appreciable quantities of manure nutrients can end up in lagoons or retention ponds. Nutrient concentrations in retention ponds will vary depending upon rainfall, evaporation, changes in pond volume, and N volatilization. In general, the high concentrations of salt, P or other nutrients in many lagoons and retention ponds limit their use as fertilizer (Wallingford, et al., 1974; Rhoades et al., 2003). However, lagoons and retention ponds are a potential site of nutrient accumulation on many farms.

Nutrient Losses, Accumulation, and Assimilation by Crops and Forages

<u>Nutrient losses from fields</u>

Runoff and leaching If manures or inorganic fertilizers are applied beyond the assimilation capacity of crops or holding capacity of soil, or if nutrients are improperly applied, losses by surface runoff and leaching can contribute to eutrophication of surface waters or contamination of groundwater. Nutrients potentially pose environmental problems not only where manure production and(or) fertilizer application rates are high, but also where environmental factors such as rainfall, leaching potential of the soil, runoff potential of the soil, and soil erosion rates are conducive to the loss of nutrients from fields (Kellogg, 2000).

Excess nutrients applied to soils can run off pastures or fields in the soluble form in water or in the insoluble form attached to soil particles. Unlike pasture systems where most of the P in runoff is in the water soluble form, particulate P is the dominant fraction of total P in runoff from row crop production (Eghball and Giley, 2001; Andraski et al., 2003). For row crops, runoff water quality depends upon soil erosion, runoff amount, manure application history, long-term tillage practices, crop residue, and P source (Eghball and Giley, 2001; Andraski, et al., 2003).

In some cases, manure application may actually help decrease runoff losses. In a summary of runoff data accumulated from 7 research stations since 1945, Gilley and Risse (2000) noted that long-term applications of manure to soils increased soil organic matter and improved soil physical properties (infiltration, aggregation, bulk density) resulting in a 2 to 62% decrease in rainfall runoff and a 15 to 65% decrease in soil losses compared to non-manured fields. Results were affected by manure application rate, manure characteristics, manure incorporation, and time between application and the first rainfall event. Under some circumstances, additional conservation practices such as buffer strips may be effective in trapping sediments, reducing runoff water velocity, and promoting infiltration.

Volatilization losses Considerable quantities of N in manures can be lost to the atmosphere, primarily as ammonia. The quantity of N lost to the atmosphere during manure application is greatly affected by the method of manure application and type of manure applied and can range from less than 5% to 60% of N applied (Kizer, 1999). Losses from fields, pen surfaces, retention ponds, and lagoons depend upon temperature, pH, N content, and wind speed (Ni, 1999).

<u>Nutrient assimilation & accumulation- Pastures and Forages</u>

Application of AFO manures to pastures is normally not a sustainable method to remove nutrients because less than 20% of the nutrients applied leave the field in animal tissues or products. Only when forage is cut for hay or silage do appreciable quantities of applied nutrients leave the field. In addition, cattle do not distribute nutrients uniformly across pastures (White et al., 2001; Tate et al., 2003). Thus, fertilizer applications to livestock pastures need to be restricted in areas with high nutrient accumulations. Use of unfertilized buffer strips around riparian areas can decrease sediment runoff from pastures by 63 to 99% (Hook, 2003).

Poultry litter Many studies have been conducted to determine appropriate applications of poultry litter for optimum yield of improved pastures. Robinson (1996) noted that N, P, and K application rates required for 90% of maximum bermudagrass yield were 440, 48, and 330 kg/ha (ratio of 9:1:6); and for 90% maximum annual yields of ryegrass were 340, 34, and 280 kg/ha (10:1:8 ratio), respectively. The average N-P-K ratio of broiler litter is 2.2:1:1.3 (Sims and Wolf, 1994). Thus, if poultry litter is applied to meet plant N or K requirements, excess P and other nutrients will be applied.

In an uncontrolled survey of Alabama farms, Kingery et al. (1994) noted that long term application of poultry litter (15 to 28 years at 6.7 to 22.4 Mg/ha) to tall fescue pastures increased nutrient content of fescue grass but resulted in accumulations of K, P, Ca, Mg, Cu, and Zn in the soil. Brink et al. (2001) compared P, Cu, and Zn uptake of ryegrass, three annual small grains, nine clovers, and three legumes on fields fertilized with poultry litter in Mississippi. Annual uptake of P ranged from 2 to 28 kg/ha, uptake of Cu ranged from 7 to 68 g/ha and annual uptake of Zn ranged from 55 to 331 g/ha. However, the relative uptake was not consistent from year to year.

Scott et al. (1995) found that as poultry litter application rate increased from 9.0 to 89.6 Mg/ha the proportion of N taken up by fescue decreased from 37 to 5% of applied N. Similarly, Brink et al. (2002) noted that net N uptake, as a proportion of that applied, ranged from 100 to 124% at the 9 Mg/ha rate and 64 to 76% at the 18 Mg/ha rate. Phosphorus uptake efficiency of bermudagrass was 31 to 46% when poultry litter was applied at the rate of 9 Mg/ha, and 17 to 22% when applied at 18 Mg/ha. To avoid P accumulation in the soil, litter applications would have to be limited to less than 4.5 Mg/ha. Copper uptake was less than 2% of that applied and uptake of Zn was 7 to 15% of that applied.

Swine effluent Burns et al. (1990) studied the effects of swine effluent application on nutrient uptake by bermudagrass (Table 2). As N applications increased in 100 kg/ha increments from 300 to 600 kg/ha, the quantity of N remaining in the soil increased by 78, 123, 173, and 228 kg/ha, respectively. Similar relationships occurred for other nutrients studied; that is, increasing

fertilization rates increased N, P, K, Ca, Mg, S, Cu, and Zn concentrations of bermudagrass but did not affect concentration of Fe or Na. These changes were related to the increase in these nutrients in the soil profile (King et al., 1990).

Brink et al. (2003) noted that cultivar significantly affected nutrient (N, P, K, Cu, and Zn) uptake of bermudagrass fertilized with swine effluent; however the relative rank of cultivars was different at two locations. The differences in nutrient uptake were primarily due to differences in DM yield, rather than concentration in herbage. At the lower application rate (6.5 vs. 10 ha-cm) Cu and Zn uptakes were equal to or greater than application rates; whereas, at the higher application rate Cu and Zn nutrient uptakes were only 15 and 50% of the application rates. Timing of application can also affect nutrient recovery (Adeli et al., 2003).

Dairy manure Soder and Stout (2003) noted that increasing dairy slurry application rates to orchard grass consistently increased dry matter yield, soil N, and soil Mehlich-3 P, K, Ca, and Mg concentrations, although there were interactions with soil type. The actual quantities of N, P, K, Ca, and Mg removed increased with increased application rates, however, the proportion of applied nutrients removed decreased with increasing fertilization rate (Table 3). Muir (2001) noted that N and P uptake by kenaf fertilized with dairy manure was relatively low, ranging from 6.8 to 10.4 % of applied P. Kuo (1981) noted no accumulations of Cu or Zn in Washington pasture soils that had been fertilized with dairy manure slurry for 20 years (approximately 10 metric tons of DM/ha)

Row crops Houtin and Paul (1998) compared the effects of 11 fertilization schemes on yield and P uptake of corn cut for silage. Hog or dairy manure composted with poultry litter was applied to fields based on the N or P requirements of the crop. Phosphorus uptake was primarily determined by silage yield and not by P concentration in the forage.

Matsi et al. (2003) fertilized winter wheat with 40 Mg/ha of liquid dairy manure (120 kg N and 26 kg P/ha annually) or inorganic fertilizers for four years. Biomass production, grain yields, plant uptake of N, P, and K, and soil characteristics were similar for dairy slurry and inorganic fertilizer treatments. Sommerfeldt and Chang (1985) and Chang et al. (1991) applied beef cattle feedlot manure to barley at 0, lx (30 and 60 Mg/ha, for dry land and irrigated, respectively), 2x and 3x recommended N rates. Even at the lowest rates there were significant increases in soil P, Cl, S, Na, and Zn concentrations.

Ferguson et al (2003) compared long-term applications of feedlot manure or composted feedlot manure based on the N (approximately 700 kg N and 300 kg P/ha) or P (approximately 250 kg N and 70 kg P/ha) needs of corn. Corn silage yields, as well as N and P uptake by silage, were affected by level of application but were similar for manure and compost (Table 4). Applying manure on a N requirement basis resulted in accumulation of nitrates and P in the top 0.3 m of soil. Phosphorus accumulation was greater with compost than with manure because of greater P applications.

Areas adjacent to a CAFO Areas adjacent to a CAFO can receive appreciable quantities of nutrients via dry or wet deposition. These might be advantageous to crops or forages that readily utilize nutrients, but may have detrimental effects to plants that are sensitive to nutrient inputs such as native range or forests (Krupa, 2003). The effects of ammonia on forests and greenhouse crops are dependent upon both the ammonia concentration and length of exposure (Van der Eerden et al., 1998).

Todd et al. (2004) noted that after 30 years of operation, dust and(or) ammonia emissions from a 25,000 head feedyard had detrimental effects on native short grass prairie immediately downwind, although the effects were minimal at a distance of 500 meters downwind. They calculated that daily deposition of particulates within 100 meters of the feedyard ranged from 0.38 g/m^2 in the winter to 3.3 g/m^2 in the summer. Estimated N deposition decreased from a range of 19 to 31 kg / ha annually 100 meters from the feedyard down to < 3 kg / ha annually at

550 meters from the yard. Soil Mehlich-3 P concentrations decreased from approximately 75 mg/kg at 100 m from the yard to background (approximately 15 mg/kg) at 600 m downwind.

Mining Soil Nutrients/Remediation of Soils

Many soils in the US contain excessive levels of nutrients such as P, Cu, Zn, Se, and As due to long term applications of commercial fertilizers, animal manure, and/or poultry litter. Nutrient accumulation in soils can lead to increased runoff, toxicity to plants, and can negatively impact the nitrogen fixation ability of legumes (Giller et al., 1989). Thus, under some circumstances, it may be necessary to develop a management plan to remove excess nutrients from the soil, while still producing a potentially profitable crop.

<u>Plant variations in nutrient uptake</u>

Some plant species assimilate and accumulate soil nutrients more effectively than others. In some cases, the increased accumulation of nutrients is determined by total dry matter biomass yield; whereas, in other cases the changes are due to increased nutrient concentration (i. e. luxury uptake) in the plant. For example, in Mississippi, Rowe and Fairbrother (2003) noted that the legumes berseem clover and red clover yielded up to 64% more N, 24% more P, 40% more Zn, and 73% more Cu than ryegrass. In Texas, McCollum and Bean (2003) reported that annual P removal by sorghum and corn silage hybrids ranged from 34 to 64 kg/ha. Phosphorus removal per unit of irrigation water used was 50 to 150% greater for forage sorghums than for corn silage. Eghball et al. (2003) and Schmidt et al. (2001) noted varietal differences in nutrient uptake by soybeans and corn fertilized with manures. Over a 2-year period there was as much as a 54% difference among corn hybrids in P removal by grain.

With bermudagrass pastures, Evers (2002) noted that over seeded annual ryegrass removed twice as much P as bermudagrass. Overseeding with annual ryegrass increased annual P removal by approximately 25 to 40 kg/ha. Pederson et al. (2002) noted that N and P uptakes were similar for ryegrass, cereals, and legume pastures fertilized with poultry litter. Potassium uptake was approximately 60% less in legumes than in grasses; whereas, Cu uptake was approximately 30% greater in legumes.

<u>Adjusting application rates</u>

Whalen et al. (2001) reported that manure applications to fields should be adjusted based on the increase in potentially mineralizable N and P from past manure applications. Eghball et al. (2003) applied feedlot manure and composted manure to corn fields for 4 years based on the N needs or the P needs of the crop to obtain soil Bray-1 P concentrations ranging from 50 to 270 mg/kg of soil Corn was then grown an additional four years with only N fertilization. The calculated time required to lower soil P concentrations to the original values ranged from 0 to over 10 years. Corn grain removed a maximum of 36 kg of P/ha with an average 4-year total of 107 kg/ha. The quantity of P removed annually by corn hybrids ranged from 26 to 41 kg/ha and P removal by soybeans ranged from 17 to 22 kg/ha. Nitrogen fertilization increased P removal by 2 fold due to an increase in yield.

<u>Combining organic with inorganic fertilizers</u>

On soils with high P concentrations, fertilizing with a combination of organic fertilizers and an inorganic N source, could potentially increase P uptake, remediate high soil P, prevent accumulation of P or other nutrients and may even be more profitable (Duffy, 1998). Evers (2002) studied the effects of combining ammonium nitrate fertilization with broiler litter application to increase P and K removal using bermudagrass – ryegrass pastures (Table 5). Applying commercial N fertilizer in combination with litter increased dry matter yields and thus increased P uptake by 23% and K uptake by 43% compared to using no N fertilizer. Forty-five to 52% of applied N was recovered in harvested forage. The percentage of K and P applied in the poultry litter that was recovered in plant biomass increased as N fertilization rate increased.

Although results varied somewhat from one location to another and from one year to another, on average, Coblentz et al. (2004) noted that P uptake of bermudagrass increased linearly as N fertilization increased from 0 to 224 kg/ha. Soil P concentrations could be decreased 10 to 20 mg/kg annually using this strategy.

Trace minerals

Significant quantities of trace minerals and heavy metals can be applied to soils with manure and inorganic fertilizers (Raven and Loeppert, 1997; Nicholson et al., 1999). In an assessment of the distribution of heavy metals in soil profiles of agricultural areas with a 25-year history of poultry litter applications, Han et al. (2000) noted that Cu, Zn, and Mn accumulated close to the soil surface at concentrations as much as 10 to 20 times of those for unamended soils. Copper was present mostly in the organic matter fraction (47%) , whereas Zn was mostly in the easily reducible oxide fraction (47%). Thus the Cu and Zn were potentially bioavailable and mobile.

Most of the research available on remediation of soils high in trace metals involves sewage sludges/biosolids. In general, biosolids application has had variable effects on crop yield and plant concentration of N, P, K, Ca, Cu, Mo, Mn, Ni, or Zn. Although biosolids sometimes increased soil concentrations of some micro-nutrients, their phytoavailability remained low (Kelling et al., 1977a, 1977b, 1977c; Jaynes et al., 2003; Shober et al., 2003). Somewhat in contrast, Wilkinson et al. (2001) reported that potentially toxic accumulations of Cd occurred in the kidneys of sheep grazing on sewage sludge fertilized pastures due to increased herbage concentrations of Cd, Pb, Cu, and Zn.

Conclusions and Applications

Although nutrient management is an integral part of profitable agricultural systems, in some areas of the U.S. continued inputs of fertilizer and manure nutrients in excess of crop requirements have led to a buildup of nutrient concentrations, which is an environmental concern. In many more arid parts of the U.S., low nutrient utilization is as much a constraint as excess manure nutrient excretion and accumulation. Proper use of nutrients contained in livestock manures is becoming more critical for sustainability of concentrated animal feeding operations, and new environmental regulations make it essential that nutrients be properly applied and managed.

Losses of nutrients such as P can be reduced by refining the rations fed, increasing nutrient retention by livestock, moving manures from areas of surplus to deficiency, finding alternative uses for manure, using cropping and haying systems that remove excess nutrients, incorporating manure immediately after application, and using conservation practices such as limited tillage, buffer strips and cover crops to limit runoff and leaching. Progress has been made. In the past three decades the total quantities of manure N and P excreted by U. S. dairy cows (Kellogg and Lander, 1999) and fed beef cattle (Greene and Cole, 2003) have decreased by as much as a third, thanks to improved feed conversions. Bundy and Sturgul (2001) noted that although Bray-P-1 concentrations in Wisconsin soils increased from 36 to 50 mg/kg between 1968 and 1994 (primarily due to inputs of fertilizer and animal manure), P inputs from fertilizers and manure decreased from approximately 115 million kg in 1980 to less than 88 million kg in 1995. Annual P excess (i.e. soil storage) decreased from 54 million kg in 1975 to 14 million kg in 1995 due to decreased inputs and increased uptake by crops.

Whole-farm nutrient balances can be a useful tool for producers to estimate the quantity of nutrients entering and leaving a farm and to identify major nutrient flow paths. However, the relationships between whole-farm nutrient balances and environmental risk can be misleading because spatial factors such as uneven nutrient application can cause an environmental risk not noted by a total nutrient balance (Bengtsson et al., 2003). Thus, average flux balances alone are not sufficient to adequately assess sustainable land use. Although a balance between manure nutrient application and crop uptake is essential to develop sustainable manure management practices, even under systems and management that make efficient nutrient

utilization and environmental concerns high priorities, some nutrient loss is inevitable. Thus, manure utilization plans also need to deal with nutrients that potentially leave the field or production area (Lowrance et al., 1985: Newton et al., 2003).

A major factor limiting use of manure nutrients is often farmers' preference for inorganic fertilizers. Thus, livestock and poultry producers need to treat manures as a co-product, rather than as a waste to be disposed of at the cheapest price, in order to make it more attractive as a fertilizer.

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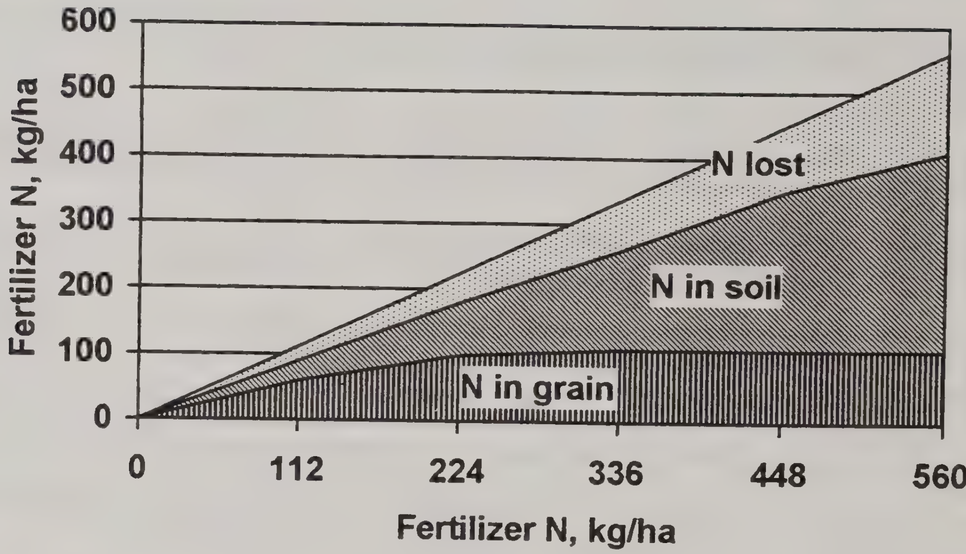

Figure 1. Relationship between fertilizer N inputs to corn and N captured in corn grain, N in soil, and N lost (Legg and Meisinger, 1982).

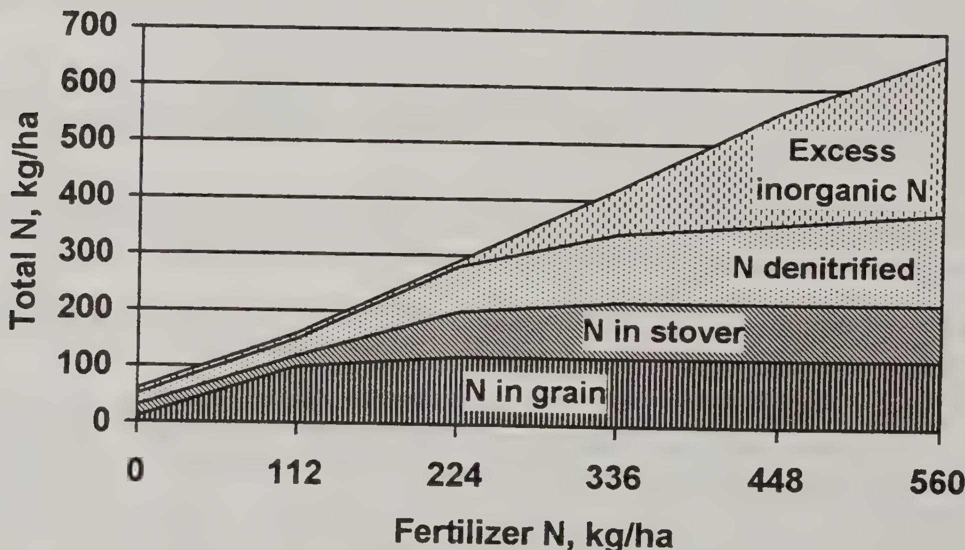

Figure 2. Average annual distribution of total N inputs in irrigated corn grown on sandy loam soil (Legg and Meisinger, 1982).

Table 1. **Range in nutrient analysis of manures for various handling systems (Klausner et al., 1984)**

System and nutrient	Dairy	Beef	Swine	Poultry
Non-liquid systems (lbs/ton)				
N	5-16	4-20	3-27	4-111
P_2O_5	2-16	1-13	1-62	1-96
K_2O	2-31	3-29	2-18	2-55
Liquid System (lb/1000 gal)				
N	3-51	6-37	1-61	35-75
P_2O_5	2-21	1-29	1-63	13-91
K_2O	2-58	5-30	1-49	13-39

Table. 2. **Effects of long term swine lagoon effluent applications on coastal bermudagrass (Burns et al., 1990)**

Item	Low application	Medium application	High application
N application, kg/ha	356	670	1340
DM yield, Mg/ha	11.1	15.2	17.2
Annual uptake, kg/ha (% of applied)			
N	303 (85)	521(78)	573 (43)
P	44 (30)	69 (25)	82 (15)
K	291 (68)	467 (59)	526 (33)
Ca	45 (56)	73 (48)	87 (29)
Mg	29 (52)	51 (47)	62 (29)
Cl	120 (42)	166 (30)	142 (13)
S	28	51	57
Cu	0.11 (15)	0.17 (12)	0.20 (7)
Zn	0.35 (37)	0.55 (31)	0.84 (25)
Fe	1.10	1.80	1.9
Na	4 (2)	7 (2)	7 (1)

Table 3. **Effect of fertilization with dairy slurry on orchard grass pasture mineral concentrations and nutrient accumulation in Pennsylvania (Soder and Stout, 2003)**

Item	Dairy slurry N application rate, kg/ha			
	0	168	336	672
DM yield, Mg/ha	3.39	4.87	6.35	8.51
Soil Mehlich-3 P, kg/ha	406	477	550	634
Soil Mehlich-3 K, kg/ha	312	529	738	958
Soil Mehlich-3 Ca, kg/ha	2,703	2,964	3,293	3,692
Soil Mehlich-3 Mg, kg/ha	235	339	420	559
Nutrient removal, kg/ha (% applied)				
N	81	121 (72)	169 (50)	243 (36)
P	15.2	22.9 (67)	29.8 (44)	38.3 (28)
K	85	139 (112)	204 (82)	294 (59)
Ca	20	27.3 (37)	31.8 (22)	41.7 (14)
Mg	8.5	11.7 (56)	15.2 (36)	19.6 (23)

Table 4. Corn silage response to manure applications for a 10-year period (Ferguson et al., 2003).

Item	Type of fertilizer and application basis				
	Manure-N	Compost-N	Manure-P	Compost-P	N-Check
DM applied, Mg/ha	74[b]	92[a]	20[c]	23[c]	0[d]
N applied, kg/ha	696[a]	711[a]	233[b]	261[b]	118[c]
P applied, kg/ha	259[b]	311[a]	60[c]	89[c]	0[d]
Silage DM yield, Mg/ha	17.3[a]	17.1[a]	16.5[b]	16.6[b]	16.0[c]
Silage N, kg/ha	214[a]	214[a]	193[bc]	196[b]	190[c]
Silage P, kg/ha	42[a]	42[a]	40[b]	40[b]	33[c]

[a,b,c,d] Means in same row with unlike superscript letters differ ($P < 0.05$).

Table. 5. **Effects of ammonium nitrate in combination with poultry litter (9 Mg/ha) application on N, P and K recovered in bermudagrass over seeded with annual ryegrass (Evers , 2002)[a]**

Commercial N applied, kg/ha	N recovered, % applied	P recovered, % applied	K recovered, % applied
0	45	21	64
56	48	22	78
112	51	25	88
168	52	27	95
224	50	27	98

[a] Nutrients applied in poultry litter = 341 kg N/ha, 203 kg P/ha, and 332 kg K/ha.

BIOSECURITY SESSION

Development of Model Biosecurity Programs

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Biosecurity is a concept that has received increased attention after the U.S. terrorist attacks of September 11, 2001, and the resulting increased public concern about the vulnerabilities of the food industry from "farm to table." In the context of this presentation, the definition of biosecurity is taken from the March 2002 issue of The Veterinary Clinics of North America – Food Animal Practice (volume 18, number 1, pages 1-6) by Dargatz, Garry, and Traub-Dargatz in which the authors state that *"Biosecurity is the outcome of all activities undertaken by an entity to preclude the introduction of disease agents into an area that one is trying to protect."* This includes both intentional and unintentional introduction of agents. However, post 9/11 (and other events that have occurred), we should consider expanding this definition to include all efforts to reduce the probability of product/input contamination or the use of an agricultural technology for illicit purposes (such as the use of transportation equipment to disperse a disease or chemical agent). The agricultural industry must also understand that reduction of *severity* of accidental or intentional events is also an important component of risk control, since 100% prevention is likely an unrealistic goal.

Bio- and agricultural security programs designed to protect animal health and minimize risk often contain components such as facility access control, personal hygiene, sanitation, and animal quarantine/isolation protocols. These protocols are often implemented using checklists that guide the manager in the process of evaluating current production practices and environmental/equipment conditions. Checklists and other text-based evaluation tools can provide a basis for continuous improvement. However, this assumes that the user (often, a livestock producer in this case) is motivated, has the resources to secure his/her operation, and can appropriately weigh potential benefits from implementing biosecurity benefits against potential risks. Unfortunately, biosecurity risks and risk factors are not yet well understood, particularly for individual operators. This is especially true as it relates to the risk levels and risk factors associated with intentional events.

We have learned in other areas of risk control, public health, and safety that the most effective measures to reduce risk and loss involve efforts to eliminate potential hazards through equipment and system-level design rather than heavy reliance on regularly occurring human action and behaviors. Biosecurity protocols that rely only on regularly performed actions and behaviors by production personnel can be highly variable in terms of effectiveness, and they are subject to competing motivations. Understanding the limitations of personnel action becomes increasingly important as animal agriculture becomes more reliant on a labor force that may include individuals with: minimal knowledge of livestock production and animal health; lack of appreciation and understanding of personal health behaviors and practices and their relation to biosecurity; and, limited ability to communicate in traditional ways based on language, literacy, and cultural barriers.

However, despite these barriers, workers themselves are still a crucial link within a successful production security program. Being on the front lines of an operation, workers are in the best position to monitor and report changes in environmental conditions, observe and report changes in animal health, suggest improvements, and provide an ongoing evaluation of an operation's biosecurity program. Other industries have recognized and embraced the role of the workforce

in implementing quality control and improvement. Workers are also the ones who will have the first exposure to hazardous biological and chemical agents that could impact an operation, and an effective biosecurity program should also have some means of monitoring and protecting worker health. Also, based on the few events in the U.S. where there have been intentional breaches of security within the food system, it is also clear that those in the labor force could also be involved in facilitating (or preventing) an event whether intentionally or otherwise. So, biosecurity programs at an operational level must include a strong, proactive, and effective personnel management program that encourages open levels of communication, encouragement of employees to be an integral part of biosecurity efforts, and empowerment of workers to bring issues, concerns, or out-of-normal-limits observations to the attention of management.

With the preceding information as background, the following are suggestions intended to help the animal industry improve existing checklist-based and other model biosecurity programs:

1. Include engineers, architects, technicians, and others who design and install livestock buildings, equipment, and other physical facilities (as well as control systems, information handling/storage systems, and other system components) in biosecurity efforts. An operation that is poorly designed (such as six ungated access points adjacent to public roads or open-sided feed/chemical/ingredient storage sheds). "Designing out" hazards is greatly preferred in the hierarchy of safety and risk control practices as compared to educating workers and relying solely on human behavior.

2. Include specific protocols and standard operating procedures in biosecurity programs that are designed to reduce SEVERITY of the impact from those events which do occur. Reducing severity is largely a function of early detection and communication with individuals representing veterinary medicine, law enforcement, emergency management, and various local, state, and regional authorities. Workers are also vital to this effort, and must fully understand and appreciate their role.

3. Encourage efforts to build relationships with production workers, regardless of language, literacy levels, culture, or level of education. Workers must be considered as partners and be fully engaged in all issues related to production, including biosecurity. Worker training should be focused around specific production protocols and standard operating procedures (including protocols for handling strangers/visitors, monitoring health status of animals, and reporting unusual personal health conditions). Additional research work is needed to examine the relationship between worker health status, animal health, and biosecurity. The three concepts are intertwined, but not yet well understood.

Catastrophic Composting: Is it Safe and Effective?

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Composting of animal mortalities has increased in popularity in recent years due to decreased availability and increased costs associated with the traditional animal rendering industry. With increasing foreign animal disease and transmission concerns, composting has received considerable more attention as a potential method for mass mortality disposal. Disposal of mass mortalities has traditionally been completed though burial or burning of carcasses. However, burning of mortalities raises concerns with airborne infectious agents. Burial is currently the main option supported by many state agencies as the preferred disposal method in catastrophic mortality events. However other disposal options must be available when limitations of carcass burial are present in areas of shallow ground water or in winter months when soil may be frozen.

Composting is the natural decomposition of organic materials by aerobic (oxygen dependent) bacteria and fungi. However, the microorganisms require certain conditions to effectively breakdown materials. The main conditions that must be present to potentially reduce or eliminate pathogens in diseased animals will be discussed briefly.

Microorganisms use carbon (C) and nitrogen (N) for energy, growth and reproduction, and ideally require a C/N ratio of 25-30:1. Fibrous materials (straw, corn stalks, silage, hale bales, wood shavings, newsprint, etc) can be used as cover materials because they contain high C/N ratios (60-850:1). Since many of these products have carbon levels that are higher then what is needed by microorganisms, manure from feedlots or pens can be blended in the covering mixture because solid scraped manure has a ratio of 10-20:1. Remember the source of C is not as important as the availability during a catastrophic event.

Moisture levels of the cover mixture should range between 50 to 60%, because active composting slows when it falls below 40% or can totally cease (< 15%). If the level is greater than 65%, pores for oxygen transfer may become blocked and odor emissions can increase. Some form of moisture should be added in most cases to cover mixtures because solid manure and C sources usually have levels below the preferred range. Wells, ponds, lagoons, or liquid manure from containment facilities can be used depending on availability. As a rule of thumb, the compost is too wet if water can be squeezed out of a handful and too dry if the handful does not feel moist to the touch.

Microorganisms responsible for effective composting require an optimum range of 40 to 65.6 C for maximum efficiency. Millner (2003) estimates that over 99% of the pathogens and parasites are killed when heated to 55 C for 3 consecutive days. Also, weed seeds can be killed from the heat generated (62.7 C) during composting. When composting normal materials, the composting pile should be turned when temperatures reach above 65.6 C, which can kill the composting microorganisms. Conversely, a pile below 40 C may indicate an inadequate oxygen level, and should be turned. If the temperature fails to rise adequately, the pile should be allowed to finish composting for at least one month or other corrective action taken. The

composting temperature can be monitored using a thermometer having a long probe, that can be inserted into the pile.

While the above conditions would be considered ideal, when composting mortalities in catastrophic situations, producers especially need to do the best job possible because they have a short period of time to create the conditions for composting. Regular management practices in creating the ideal composting conditions, such as turning the pile to help regulate temperature, oxygen levels, and mixing of the materials, may be limited due to exposing carcasses to open air. However, depending on the organism that needs to be eliminated, this may still be a safe practice as long as adequate temperatures have been maintained prior to turning of the pile.

Senne et. al (1994) evaluated the survival of highly pathogenic avian influenza virus and egg drop syndrome-76 during composting. They used tissues from chickens infected with highly pathogenic avian influenza virus, and tissues from chickens infected with egg drop syndrome-76 virus, distributed among the chicken carcasses. In a compost mixture, they included in a ratio of one part straw, one part carcasses and two parts manure (vol/vol). They tested tissues at d 10 of composting, turned the pile, and then retested tissues 10 d later. The avian influenza virus was not detected after 10 days of composting. The egg drop syndrome-76 virus could be recovered at 10 days but not at 20 days of composting.

Current research by Granville et al. (2004) is evaluating the potential of composting to control other catastrophic viral disease outbreaks. Briefly, they are evaluating pathogen inactivation vaccine strains of poultry viruses placed inside the composting piles in retrievable containers (dialysis cassettes and cryogenic vials). A commercially licensed (B1 Lasota) vaccine strain of Newcastle Disease virus (NDV) was first used to evaluate the potential biosecurity risks from composting. NDV is a single-stranded RNA enveloped virus that is highly representative of other viruses, such as influenza viruses. Preliminary results indicate that no viruses were detected in either container at d 8 of composting in mixtures of straw/manure, cornstalks or silage. Also they evaluated if the viruses would escape the composting mixture and effect surrounding livestock. This was done by inoculating and propagating viruses inside chicken eggs, and then distributing the eggs (and their contents) throughout the composting test piles before the cover material is added. They used specific pathogen free (SPF) sentinel chickens stationed in cages located 10 feet from all sides of the composting test units. Results indicate of the 48 caged pathogen-free birds stationed around trials none have tested positive for NDV antibodies during the 10-12 week blood sampling and testing period. In addition, the authors are currently evaluating the effects of a commercially-licensed vaccine strain of avian encephalomyelitis (AE) virus that was used to emulate foot-and-mouth (FMD) virus. However, this data is not available.

Recently, Bovine Spongiform Encephalopathy (BSE) has raised concerns about traditional rendering and the lack of destruction of the prions associated with the transmission of this disease. Bagley et al. (1999) indicated that prions are not destroyed by composting. Therefore, animals infected with Transmissible Spongiform Encephalopathies (TSE's) should not be processed via composting, because the infectious agents will still be present after the composting of the animal carcass. To our knowledge, research has not been competed to determine if plants can uptake prions in soil if compost is spread onto the land containing prions.

Under practical conditions of mortality composting, Looper (2002) reported that after 2 months of composting mature dairy cows, the flesh was 90% decomposed and after 4 months only 7 to 10 bones per carcass remained. This study indicated that the internal temperature reached 61.1 C after three days of composting. While they did not test for pathogen levels, the temperature should have been adequate for their destruction. In this study, the piles were not turned, no additional moisture except 5.08 cm of rainfall was added to compost piles and the initial mixture had a C:N ratio of only 12:1. The authors acknowledged if the conditions for ideal composting were used the time in which the composting process took place would have been

reduced. However, they tried to simulate an on farm situation for the producer with whom they completed the study.

Also, Murphy et al. (2003) composted 275 – 450 kg beef cattle mortalities with different material mixtures. They used 1) straw; 2) saw dust; 3) compost; 4) 50% straw – 50% saw dust; 4) 50% straw – 50% compost; and 6) 50% saw dust – 50% compost. During the first month, temperatures for the straw - saw dust mixture reached the highest level at 60 C and averaged 55.8 C. However, the compost and compost-C during the first month. While pathogen levels were not measured, this may indicate that infectious pathogens would not have been destroyed in those mixtures. All other mixtures did have temperatures that rose above 55 C. They also observed the mortalities had lost most of the fleshy tissues, internal organs, and hide leaving the structurally sound bones after one month. The material next to the animal had turned to a gray colored ash.

Bagley et. al (1999) suggests that mortalities over 136 kg be laid on their back and split, exposing the internal organs for more rapid composting. While this does increase the surface area in which microorganisms can degrade the tissues and potentially speed up the composting process, employee health and safety concerns are issues with splitting carcasses, especially in catastrophic events.

Numerous publications and information from University Extension Services are available for proper design of mortality composting sites (Carter et al. 1996; Keener et al. 1997; and Granville et al. 2004. This information is out of the scope of this paper. However, sites need to be selected that are not public health risks, from either air, water, or from direct contact if the infectious agents that are being composted can pose a direct threat to humans and other animals. All activities with composting will require some human activity, which may have direct health concerns if the disease is highly contagious and proper handling procedures are not followed. Mortality composting sites must follow strict biosecurity plans set forth by state or local emergency plans.

Catastrophic composting can be an effective disposal method. This is especially true in destruction of viral disease agents. However, further research needs to be completed to verify safety and efficacy of composting mortalities as the result of other infectious diseases. While mortality composting does show promise, burial will be the major disposal method used in mass mortality situations. Exceptions will be when limitations of shallow ground water or frozen ground in winter months prevent its use.

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Extension's Roles in the Early Detection of Bioterroism/Agroterrorism Events

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Agroterrorism is the intentional harming of a nation's agricultural infrastructure by the use of biological weapons and is a type of biological warfare. Bioterrorism is defined as the use of biological agents to intentionally produce disease or intoxication in susceptible populations to meet ideological goals: religious, political, economic, ethnic, or cultural. Domestic animals and crops represent a significant target. An attack on our agricultural industry would cause economic upheaval, undermine public trust and confidence in the safety of our food supply as well as in our government's ability to protect public infrastructure (Mattix, 2004). While fear is a component with agroterrorism, the primary outcome is severe economic losses and a decreasing export market. If we cannot export, we lose money, farms, jobs, and international stature. Export revenues accounted for 20-30% of farm revenues over the last 30 years and are expected to continue in this fashion in the future. All told, we exported nearly $51 billion in agricultural commodities in 2000 (Unknown author, 2003).

Any species of economic importance can be a target for an agroterrorism event. High concentration of animals in feedlots, swine confinement units, or poultry houses could aid in the distribution of an agent. Auction markets mix animals and transport them, often long distances, where they are mixed with other animals. Since almost all severe, highly contagious diseases of livestock have been eradicated from the U.S, and the use of any vaccine for them is either nonexistent or rarely employed, U.S. livestock have limited immunity and therefore are highly susceptible to foreign animal diseases (FADs).

Many of the potential bioterrorism agents are zoonotic, that is, transmissible from animals to humans. In some diseases, clinical signs may manifest in animals prior to humans. As such, animals serve as vital sentinels for human disease. Pets in particular can act as important sentinels because they are present in large numbers and often live in close contact with humans. It is estimated that pets are present in 59% of U.S. households (Unknown author, 2003). Livestock are also present in high numbers especially in certain areas of the country. Many areas depend on livestock for their livelihood and this puts them at risk for bioterrorism or agroterrorism.

It can be difficult to detect when biological agents are released. Dissemination often covers a large geographic area and clinical cases may take days to weeks to recognize. There is also the possibility of secondary spread if the agent is contagious person-to-person or through a vector. In many respects, a biological attack is likely to resemble the occurrence of a natural disease outbreak.

Historically infectious disease outbreaks are first recognized at the local level. For this reason, the professionals in the fields of veterinary medicine, public health, health care, and plant pathology represent the first line of defense in a biological attack. These professionals, as well as producers, should be aware of some of the signs that may be seen in one or more facilities and may be present in an outbreak. Sudden unexplained morbidity or mortality in livestock/poultry, vesicles, or any unusual event may indicate a Foreign Animal Disease threat. The specter of bioterrorism now requires the cooperation and coordination of veterinarians,

public health epidemiologists, and the law enforcement community in investigating unusual disease outbreaks- the fusion of epidemiological and criminal investigation (Mattix, 2004).

The importance of local surveillance and preparation cannot be overemphasized. Organization of local response requires time and effort, to a large degree by volunteers. State and federal officials depend heavily on immediate local response to contain emergency situations as the responses of state and federal agencies come into play.

Awareness education is the cornerstone for success in preparedness and protection. Establishing "relevance" is an important aspect. There is a need to "sensitize" veterinarians, agricultural associations (livestock, poultry, and crop), other state and federal agencies, and producers to the threat of bioterrorism/agroterrorism, pointing out that the threat does exist and Americans need to be educated about it. The degree to which such individuals are alert to the threat of bioterrorism will determine the effectiveness of surveillance activities.

The threat of bioterrorism is more likely now than any other time in history and presents new and daunting challenges to government officials. Preparedness will require not only close communication and coordination among the public health, medical and veterinary communities, but will also require the formation of new partnerships with law enforcement, civil defense, and our military. Preparedness will also require forming nontraditional partnerships with a diverse set of professionals to "cast a broader net" of information gathering- fish and wildlife officials, 911, pharmacies, dial-a-nurse, humane societies, and extension (Mattix, 2004).

The role of extension in this process is a natural fit. Extension personnel are professional agricultural representatives whose primary mission is education. The very strength of extension is its diversity of audiences. Local extension offices have daily contact with many facets of agriculture and are in a position to recognize an unusual occurrence or a suspicious set of circumstances. Biosecurity is defined as any practice that prevents the introduction or spread of disease on the farm. Biosecurity is a concept commonplace in production agriculture and, based on their agricultural background, extension specialists have an ingrained appreciation of this concept. As a recognized member of the local community, who better to work with other local officials to disseminate information to the public, serve as part of the local surveillance network, and establish relevance to the threat of bioterrorism?

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INTERNATIONAL SESSION

OIE International Standards on Animal Welfare, EU Country Regulations, and Their Impact on USA Trade and Regulations

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Among the several primary objectives of the World Organization for Animal Health (OIE) is the setting of animal health standards for safeguarding international trade. In order for countries and their stakeholders to maximize the benefits of globalization, they must become familiar with, and must adhere to the rights and obligations set out by the World Trade Organization, under the Agreement on Sanitary and Phytosanitary Measures (WTO-SPS). Under the obligations of this agreement, countries must adhere to the standards, guidelines and recommendations established by the OIE, on matters related to animal health and zoonoses. Among the more important special provisions of the WTO-SPS agreement are those on harmonization, equivalence, assessment of risk and appropriate level of protection, regionalization, transparency and notification.

Possibly the most important of all special provisions of the agreement is the one on harmonization. Under harmonization, the agreement encourages its members to formulate their domestic sanitary measures utilizing the international standards, guidelines, and recommendations. The benefit of harmonization of animal health activities includes sanitary safety, promotion of veterinary services, transparency and international solidarity.

Animal welfare is not one of the topics identified by the SPS agreement for the purposes of international trade. However, animal welfare is an important subject within the strategic plan of the OIE, and should be addressed in the same scientific manner as the development of standards and guidelines for the protection of animal health. Utilization of harmonization and equivalence principles are concepts of immediate concern within the United States as the European Union and other trading partners develop animal welfare regulations. Under the concept of equivalence, the agreement indicates that countries shall accept the measures of other members as equivalent, even if they differ from their own and from those applied by others trading in the same product. For this purpose, the exporting country must objectively demonstrate to the importing country that the proposed measures achieve its level of protection. The intent of this provision is to encourage trading partners to focus their attention on the desired objectives of the measures rather than comparing measures for sameness.

It is the international recognition earned by the OIE and the scientific approach in developing standards that will provide the foundation for the development and acceptance of science-based animal welfare guidelines by all OIE member countries. These guidelines and recommendations will become the foundation for bilateral trade agreements between OIE member countries.

Use of Antibiotics and Alternatives in the Animal Industries, What is Extension's Role?

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The use of antibiotics to keep food animals healthy is a continuing source of controversy, despite several recent, peer-reviewed publications documenting the extremely low risk of using these products and pointing out previously unrecognized benefits. To a great extent, the controversy is kept alive by the continuing efforts of a coalition of activist groups under the umbrella name "Keep Antibiotics Working." The focus of the individual groups range from food safety to anti-factory farming to anti-meat consumption. The advantage that such activists groups have in drawing general media and public attention to this issue is that it is a highly technical, scientific issue. Understanding the real risks and benefits requires an understanding of fairly advanced science. And the media and public do not deal in the arena of advanced scientific concepts.

As a result, we know from consumer research that the public has basic misconceptions about antibiotic resistance as it relates to antibiotic use in animals:

1. The public believes resistance is transferring by antibiotic residues in meat – which is not true;
2. The public believes people acquire resistance over time – which is not true.

Producers can be confused as well. Publications questioning the efficacy of antibiotics as growth promoters, which are not based on the rigorous FDA data requirements manufacturers must meet, are embraced and touted by activists whose broader goals are in no way compatible with those of food producers.

What can Extension do? Extension's core role is education, and data-informed education, of both producers and consumers, is what is most sorely lacking in the debate over the role of antibiotics in food animal production. There are several areas where Extension's ability to provide education could be of assistance:

1. Evaluate efficacy of products and of alternatives. Sometimes lost in the debate is the fact that all products must go through an FDA approval process that requires sponsors to provide data proving the safety and efficacy of the product. That means that for each antimicrobial on the market there is data on file at FDA showing the product works as intended, is safe for the animal, and safe for the consumer who consumes meat from the animal.

   While there have been many suggestions that alternatives exist for antibiotics, particularly those used to promote growth and efficiency, these products must also be accompanied by data from trials that demonstrate their safety and efficacy before they can be considered true alternatives. Without such an approval from FDA, producers can treat "alternatives" much the same way they would treat non-FDA approved medicines for their family members.

2. Be familiar with and able to communicate the evolving science on antibiotic resistance. Recent publications reviewing data-driven risk assessment suggest an extremely low risk from the use of antibiotics to keep animals healthy. At the same time, published reviews suggest there are previously under-appreciated food safety benefits to the use of antibiotics to keep animals healthy. This information is important decision making information for consumers who are barraged by a flurry of marketing claims that masquerade as food safety claims.

3. Help producers become familiar with and employ judicious use principles. There is always room to improve the use of antibiotics – in both human and animal health. The veterinary community, in conjunction with FDA and species groups, has produced species-specific judicious use principles to help producers make sound, science-based decisions about the use of antimicrobials.

4, Educate society about risk. As a society, we tend to be scared of things we shouldn't be and not scared of things we should be scared of. It's why some people drink bottled water while failing to use their seatbelts when driving. In this context, this principal can be demonstrated by a couple of simple questions.

   a. Which is the greater risk for contracting an antibiotic resistant illness – going to the hospital or eating meat?
   b. From the standpoint of bacterial contamination, which is safest to eat: organic meat and produce or conventionally-raised meat and produce?

Extension can help consumers better understand the difference between real and perceived risks.

Understanding Country of Origin Labeling

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Animal agriculture has been buffeted by external factors during the brief introduction to the new century. Trade issues and government regulations are typically reserved for crop farmers, but avian influenza, FMD, BSE, and country of origin labeling (COOL) are all external factors that have or will impact US livestock producers. While animal diseases like avian influenza, FMD, and BSE have established international rules that the US must follow, COOL is legislation to require retailers to inform domestic consumers of the origin of the food they purchase. The legislation was supported by many but not all US producers, consumers, and trade organizations and remains a very controversial topic. COOL was part of the 2002 Farm Bill that was signed by the President in May 2002, became a voluntary program September 2002, and was slated to be mandatory beginning September 30, 2004. A lengthy and controversial rule writing process followed with USDA openly criticizing the legislation at congressional hearings and holding public forums to gather comments. Cost estimates and impacts from proponents and opponents alike were widely published and picked apart. Central to the debate is a wide difference of opinion on what the law requires and of whom.

True to the saga of COOL, its implementation was delayed until September 30, 2006 as part of the omnibus spending bill passed in January 2004. At this writing there is a bill in the Senate to reinstate mandatory COOL for this fall. Industry groups continue to work on how to design and implement a labeling program on a voluntary basis. Proponents of mandatory COOL argue that voluntary programs haven't worked in the past so it is time to make it mandatory because, they argue, producers and consumers want it. USDA Economic Research Service released a study of COOL in late January 2004 that puts forward the argument that if there was a premium for US labeled meat that was large enough to pay for the cost of implementing it then some private sector company would have such a program. For now the implementation of COOL is on hold, but the debate will continue.

Since COOL was passed into law BSE was found in the US and USDA has announced plans to implement a national animal identification system. Plainly said, national ID is not COOL. Nor will COOL fulfill the function of a national identification program. They complement each other, but one cannot substitute for the other. Perhaps not surprisingly, supporters of COOL are often opponents of national ID and vice versa. The similarity in the rhetoric and timing of the discussion further complicates the issue in the minds of producers. This brief article will attempt to provide Extension personnel working with livestock producers the background to understand COOL and the differences between it and national animal ID and provide links to resources for more information. This paper is based on information in late spring 2004 and the COOL rules have not been finalized.

Country of Origin Labeling

Country of Origin Labeling was in Title X, the Miscellaneous section of the 2002 Farm Bill. The legislation is targeted at regulating and enforcing the law at the retail level. In turn, retailers will have to require certain information of suppliers to comply with the law. It states that retailers shall inform consumers at the final point of sale of the country of origin of covered commodities. Covered commodities include muscle cuts of beef, veal, lamb, and pork, ground beef, lamb, and pork, farm-raised fish and shellfish; wild fish and shellfish, fresh and frozen fruits and

vegetables, and peanuts. There is an exemption for food service, small retailer grocery stores, some specialty shops, and for many processed products. Thus, COOL applies almost exclusively to retail grocery stores that sell approximately half of the food in the US. Consumers of meat will be informed in which country the animal was born, raised, and slaughtered. The irony is that the law also states that the Secretary cannot require mandatory animal identification to implement COOL.

The law made some specific requirements and left some discretion to the USDA Agricultural Marketing Service, that is responsible for writing the rules to comply with the law (Federal Register). The law states that to carry the USA label meat items must be exclusively born, raised, and slaughtered in the United States. Products that are not exclusively US would be labeled as "Born in country X, raised and slaughtered in country Y," or "Born and raised in country X and slaughtered in country Y". The product may also be labeled as "Imported from country X and slaughtered in country Y". As long as the locations of birth, raising and slaughter are identified the product can still be sold at retail outlets. *However, meat products without country of origin documentation cannot be marketed through retail outlets.* These products will likely be channeled to food service, additional processing, or some other exempt.

The law also states that the Secretary "may require that any person that prepares, stores, handles, or distributes a covered commodity for retail sale maintain a *verifiable recordkeeping audit trail* that will permit the Secretary to verify compliance. USDA has not defined what constitutes a verifiable record trail, but has stated that "self-certification" is not sufficient. The requirement of an audit trail sparked significant saber-rattling in the countryside from packers to producers and retailers to packers as each tried to push the liability one rung lower on the ladder. Packers sent letters to farmers stating that the farmer was responsible for the cost of "3rd party" verification even though USDA hadn't defined "verifiable". The same letters suggested that if producers would inform their congressmen of this problem COOL could be killed. In discussions with USDA the auditable trail is just that. Records kept on the farm that can be audited if the need arose. Individual supply chains may require more, but that is at their discretion. USDA does not expect to conduct random audits on the wholesale or farm level. Any audits at these segments of the production chain would be a result of complaints originating at the retail level.

AMS received numerous comments from retailers emphasizing the need to hold retail suppliers accountable becuse the retailer would be unable to determine a product's country of origin in the absence of credible information from the supplier. Under the statute, suppliers of covered commodities are required to supply country of origin information to retailers and sanctions may be assessed against retailers only for willful violations. AMS invites further comment on the practicality of requiring suppliers to provide an affidavit for each transaction to the immediate subsequent recipient certifying that the country of origin claims being made are truthful and that the required records are being maintained. Finally, regardless of how costly compliance may be at the farm level, there will still be costs associated with product segregation and labeling beyond the farm gate.

Bones of Contention

As stated earlier there is significant disagreement over what producers are required to do to comply with the law. Proponents of the law generally believe that US livestock producers will have very little impact from COOL, and that the burden of labeling falls primarily to importers and processors. USDA addresses two of their primary arguments in its latest proposed rules (Becker). These are the definition of "covered commodities" and the "presumed US" approach.

> The legislation identifies covered commodities as beef, pork and lamb, not cattle, hogs and sheep. Yes, but USDA writes that the law requires suppliers to provide country of origin information to retailers, including the "born, raised, and slaughtered" information required to make U.S. origin claims for the covered commodities beef, pork, and lamb. The records needed to substantiate this information can only be created by persons

> having first-hand knowledge of the country designation for each production step declared in the country of origin claim. Thus, livestock producers will need to create and/or maintain these records to enable retail suppliers to provide retailers with correct country of origin information.

Thus, producers of animals that produce a product to be labeled must still keep records and keep them accessible.

The second argument and probably the most heated one is the idea that the US make a condition of import be that all are imported animals are identified and any animal that is not labeled is presumed to be from the US. Mexican feeder cattle already receive a jaw brand to identify them as imported from Mexico and Canadian feeder pigs receive a metal ear tag. If Canadian cattle were permanently identified with a brand then practically all imported animals would be identified. It would then be the packer's responsibility to watch for these tags or brands and while the packer may require the seller to alert them to imported animals in a lot, US producers would not be responsible for record keeping of informing buyers. USDA's response to this presumed US argument is:

> *The COOL provision of the Farm Bill applies to all covered commodities. Moreover, the law specifically identifies the criteria that products of U.S. origin must meet. For beef, pork, and lamb, for example, U.S. origin can only be claimed if derived from animals that are born, raised, and slaughtered in the United States. The law further states that "Any person engaged in the business of supplying a covered commodity to a retailer shall provide information to the retailer indicating the country of origin of the covered commodity." And, the law does not provide authority to control the movement of product, imported or domestic. In fact, the use of a mandatory identification system that would be required to track controlled product through the entire chain of commerce is specifically prohibited.*

This suggests that it is the producer's responsibility to inform the next person in the supply chain as to the location of birth and where the animal was raise.

COOL Cost – Benefit Analysis

There is significant disagreement over the cost of COOL and who will pay. One argument is that a label that says USA can't cost a penny so how can COOL be costly? It is not the label that is costly, but rather it is the integrity of the system behind the label. There have been numerous analysis of the costs and benefits of COOL with the magnitude of each driven mostly by the level of detail in the audit trail. The USDA Economic Research Service estimated the cost to be between $587 million and $3.9 billion. Other researchers estimated the costs to range from $276 million (Van Sickle et al., 2003) to over $6.3 billion (Davis). All agree that there will be some cost to comply with COOL. They disagree on how large and who will pay the costs.

Van Sickle et al. (2003) have estimated the benefits that consumers would pay will out weigh the cost to implement COOL. Umberger et al. (2003) used experimental economics to try to gauge the consumer's willingness to pay for COOL. The study found the consumers preferred a steak labeled, "USA Guaranteed: Born and Raised in the United States of America" over a steak with no label of any kind. However, USDA Economic Research Service released a study of COOL in late January 2004 that puts forward the argument that if there was a premium for US labeled meat that was large enough to pay for the cost of implementing it then some private sector company would have such a program.

One scenario often overlooked is that consumers may not be given a choice between US and some other country at the retail counter. Imported beef represents less than 20% of US

supplies if you count cattle and beef. Imported pork would be a smaller share yet. The exempted markets, most notably food service accounts for about half of the food consumed. It may be possible that a high percentage of the meat that is not US is routed through food service where labeling is not required.

What should producers do?

Start keeping records!!! One strategy that appears promising is the Internal Revenue Service model: trust, but verify. Producers could self-certify the COOL information, but keep records on site if there is ever an audit. USDA writes "The COOL law requires firms or individuals that supply covered commodities to retailers to provide information indicating the product's country of origin. This information must address the production steps included in the origin claim (*i.e.*, born, raised, and slaughtered or produced). Self-certification documents or affidavits may play a role in assuring that auditable records are available throughout the chain of custody, but the auditable records must themselves also be available to ensure credibility of country of origin labeling claims." The USDA has also provided example records for different segments of the industry at http://www.ams.usda.gov/cool/records.htm .

National Animal Identification

It is important to realize that national animal identification and COOL are different. COOL is a marketing program intended to inform all consumers at the retail grocery counter what country the meat was born, raised and slaughtered in. The national ID program is an animal health program that can trace every animal to every farm or market on every day of its life but tells no one unless needed for animal health emergency.

One of the additional safeguards that Secretary Veneman announced December 30 was to accelerate the implementation of the national animal identification system. USDA announced April 27, 2004 their proposal for the National Animal Identification System (NAIS) that builds on the USAIP. A collation of USDA and animal agriculture has been working on a plan for the development and implementation of a national animal identification system. The US Animal Identification Plan (USAIP) was presented at the US Animal Health Association in October. (For more information go to www.usaip.org). The motivation for the USAIP is three-fold:

1. protect US animal health from disease,
2. address potential food safety concerns
3. assure access to markets.

The USDA is still accepting comments on the plan and the final version may look different than the initial USAIP. The current discussion centers around using electronic ear tags for cattle and other animals that are handled as individuals and group identification for hogs and poultry that are handled as groups. There will also be a unique premise number to each location where animals are located including facilities, feedlots, auction markets, packing plants, fair grounds, etc. Extensive pasture systems may be able to identify the headquarters as the premise rather than assigning each pasture as a premise.

The following timeline for adoption was proposed in the USAIP last October is considered by most to be aggressive. Secretary Veneman announced in late January that USDA would accelerate implementation of a national ID system and put $33 million in the budget to help make it happen. Target dates and activities that were in the October USAIP are:

1. July, 2004: all states have a premises identification system in place,
2. February, 2005: unique, individual or group/lot numbers be available for issuance,
3. July, 2005: all cattle, swine, and small ruminants possess individual or group/lot identification for interstate movement;
4. July, 2006: all animals of the remaining species/industries be in similar compliance.

The underlying goal of the USAIP is to have the ability to conduct a complete traceback of an animal within 48 hours of confirmation of a disease diagnosis. To achieve that goal the plan will identify individual animals (cattle and breeding animals) or groups (market hogs and poultry), identify the premises where they are located, and the date an animal enters or leaves that premises. Thus, there will be four pieces of data collected each time the animal changes premises:

1. the tag number,
2. the premise number of the location the animal is leaving,
3. the premise number of the location the animal is entering,
4. the date of transfer.

The devil is in the detail, but the current discussion is to use private sector companies to service producers, sell the tags, readers, and software, and require that the companies send the four pieces of required data to the national database. Producers that are only tagging cattle to comply with the law will only need to be able to tag the calf or take it to an auction that is a designated tagging location. Design and details also may change before the program is finalized. Producers that want to use the tags and electronic data in their management system will need to own or have access to the readers and software.

While the arguments against a national ID system began to lose steam after December 23rd, there are still concerns that need to be addressed for the program to be successful. First, there is a concern about who has access to the information in the database. The USAIP calls for agriculture to be designated as a critical infrastructure and information required by the USAIP would be protected from public disclosure under the Freedom of Information Act. The only people that would have access to the national database would be approved federal and state animal health officials conducting an investigation. No other individuals will have access to the database including buyers or sellers of livestock. Second, where does the producer's accountability and liability end? We currently have meat recall capabilities that can trace meat from the retailer to the front door of a plant. The proposed USAIP will provide traceback from the back door of a plant to each farm and market that the animal was on. Does the USDA plan to link the ID across the plant? Currently, the producer is linked to the carcass at least to the grading station because grid markets determine price at grading. It is much more costly to trace all of the pieces of meat back to a carcass once it is fabricated. That link also poses the greatest liability concern to producers. In Canada, the farmer's responsibility ends at the inspection station, Third, what will it cost and who will pay? Perhaps more importantly, what incentives are there for producers to participate? Requiring an ID tag as a condition of sale is one motivation, but is more of a stick than a carrot.

Once an electronic animal ID system is in place to meet the animal health and food security aspects, the infrastructure can be used for other purposes. If producers are required to have the tag, they may decide to store their management information electronically as well. Producers may also choose to sell the pertinent management data with the calves to the feedlot, i.e., vaccination program, treatment records, birth dates (think of the packer age certification program mentioned above).

Would COOL have prevented the Holstein cow in Washington state from entering the US, aided in the traceback, or aided in the detection of BSE? In short, no.

1. COOL is not expected to prevent imports, but rather inform consumers at the retail grocery counter which country the product was born and raised in.

2. As written, COOL cannot require mandatory animal identification. It does not assist in traceback to individual farms only to the country of origin.
3. COOL does not change the testing protocol or prevent product from entering the market as livestock without country of origin information can be sold through food service.

Would a national animal identification have prevented the cow from having BSE or from entering the US or informed consumers that the product was from Canada? No.

1. A national id program does not prevent disease or imports.
2. The proposed national ID doesn't tell processors, retailers, or consumers of the origin of the animal.
3. It would assist USDA with the investigation to find the birth farm and where it was raised.
4. More importantly it would also identify other animals that were on these farms that may have been infected and where to find them today.

A combination of COOL to inform consumers and national ID to provide accurate information would help achieve both goals. However, whether national ID is used for COOL or we use the "presumed US" approach of only identifying imported animals and products the cost beyond the farm gate are similar. These are also the more costly part of labeling.

Making Lemonade from Lemons: Source-Verified Supply Chains and Branded Beef

The national ID program will identify animals from birth to slaughter, but will not provide source verification. However, the required infrastructure will provide the private sector the opportunity to create and capture value from information. The idea that some calves are worth more than others because of information about the calves is not new. We talk about reputation calves all the time. Knowing how the calves will perform in the feedlot has been important because of gain and feed efficiency. Performance in the cooler become more important with grid marketing as premiums and discounts increased. Research on over 1100 steer test cattle fed in Iowa indicates that in a $8 Choice-Select spread that grading out-weighed feed efficiency and ADG for the most economically important factor. We are now beginning to realize that calf health not only impacts feedlot performance, but also grading so cowherd health practices are important to the feedlot. Not only does treating sick animals increase cost of production, but their performance *and* grading suffers. The genetics and management practices that can impact all of these attributes are often difficult to detect from even the front row of the auction market. Special sales with common management practices, single breed or breeder genetics, and other programs that convey more information to the buyer are increasingly popular. A national ID system will improve the opportunity to prove and pass information from seller to buyer regardless of how the cattle are sold.

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Opportunities for Extension Professionals in International Education

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Abstract

There are numerous opportunities for international colleagues, bound by a common thread, to share in the exchange of information. Numerous organizations support agricultural based projects overseas, with a major source of funding originating from the U.S. Agency for International Development (USAID) via the US Farm Bill. Partner organizations that share in this funding through the Farmer-to-Farmer program include: ACDI/VOCA (Agricultural Cooperative Development International and Volunteers in Overseas Cooperative Assistance), Citizen's Network for Foreign Affairs (CNFA), Land O'Lakes, Inc., Partners of the Americas, Citizens Development Corps (CDC) and Winrock International. These programs rely on the expertise of volunteers from U.S. farms, land grant universities, cooperatives, private agribusinesses and nonprofit farm organizations to provide assistance to individual farm enterprises, cooperatives, farmer's associations, agribusinesses, rural credit institutions, universities, and agricultural youth groups overseas. Commodity groups such as the American Soybean Association (ASA) and U.S. Grains Council (USGC) also recruit experts that are involved with technical programs that teach livestock and poultry producers how to use feed grains effectively and manage operations efficiently. The Fulbright Scholar Program administered by the Council for International Exchange of Scholars (CIES) offers opportunities for international educational exchange. Fulbright grants are awarded to U.S. citizens and nationals of other countries for a variety of educational activities which may include, university lecturing, advanced research, graduate study, and teaching in elementary and secondary schools. The primary mission of extension is to "take the university to the people". Whether the scope is local, regional, national, or international, the essence of extension supports key projects, which may include the building of partnerships, improvement of business practices, increasing productivity and profitability, and introducing new technologies. In addition, opportunities for scientific exchange contribute to an increased understanding of history, culture, politics, and social structure.

Foundations of Extension

The roots of extension date back to the 1860's when Congress created the land-grant university system to house research programs of benefit to the farmers of rural America who were unable to afford higher education. In the early 1900's, the first Extension agents began taking the university directly to the farm, helping farmers learn ways to grow and manage their crops and provide better lives for their families. Extension agents have been able to effect positive change for almost 100 years, not only on our farms, but in all walks of life, through programs based on cutting-edge research from the land-grant universities.

The land-grant mission and teaching outside the classroom gave rise in 1914 to the national Cooperative Extension Service, whose mission was to "take the university to the people". The goal of the 1914 Smith-Lever Act was designed to "....aid in diffusing among the people... useful and practical information...(via) instruction and practical demonstration. Improvements in educational level and the quality of life of individuals worldwide have been noted. There are approximately 184 countries that have developed an extension system that is based on many of the same concepts and principals established in the United States (Swanson *et al.*, 1990). As there are similarities, there are also differences in extension systems from country to country. It

must also be noted that the United States was not the first to implement an extension system and the land-grant university model of extension is not the only one utilized internationally.

Japan was the first country to establish a formally organized extension service in 1893 and the United States followed in 1914. The next formal extension program was not established until 1946 in the United Kingdom (Swanson *et al.*, 1990). From 1900 to 1959 approximately 54 agricultural extension organizations were established and from 1960 to 1990, an additional 130 extension organizations were established. Reasons contributing to the expansion of extension include:

1. Reorganization of existing agricultural ministries to include an extension division,
2. Increased efforts to support international aid with emphasis to provide technical assistance in support of agricultural growth,
3. Increased trade and economic expansion worldwide has influenced the need for the dissemination of information, and
4. Improvements in communication and modern transportation have also contributed and made it possible to provide extension services more efficiently.

Functions of Extension

The primary function of Extension is to deliver research-based educational programs that target a primary industry, allied industries, governmental agencies, international organizations, individuals or other institutions that are relevant to the support of their production system, which would result in the improvement of their quality, safety, efficiency and economic well-being. The Extension function targets the non-traditional student who is not enrolled in a formal degree program. Technology transfer and implementation via empowering of clientele through educational programs are the primary goals. On-site consultations, invited presentations, seminars, short courses, publications, and applied research are also conducted and/or disseminated for regional, national and international audiences. A primary objective is to maintain a comprehensive unified program that supports all sectors of the targeted clientele. Programs should be under constant revision to effect maximum control and should be spread across all sectors of the production system. Program delivery methods, ranked by effectiveness, continue to be: (1) On-site consultations, (2) Invited presentations, seminars, short courses, (3) Publications - popular press, extension, refereed journals, electronic based information and the Internet, and (4) Applied research through result demonstrations.

The relationship of Extension with agricultural production is one of its most valuable resources, which supports the structure for Extension-based programs. A strong partnership with the production system lends the opportunity to cooperatively plan and implement educational programs and technology transfer linkages that address the needs of the agricultural production system at hand. Most, if not all, technical innovations must be identified, implemented and evaluated within the economic and operational confines of the specified system. Although technology transfer is of paramount importance in program delivery, it is accomplished by empowering the clientele through individualized training and continual education. This function is invaluable for personnel in all phases of the production system, in order to make timely and relevant decisions both now and in the future.

Program implementation and presentation sets Extension apart from other organizations and adds great value and credibility to its program. Program design and delivery vary with targeted audiences and must be tailored to focus on individuals, groups, phases and/or situations within and among targeted clientele. The extension function must be considered a valued resource for successful linkage in program delivery. Although mass media, publications, seminars, clinics, and short-courses are quite useful in the dissemination of extension programs, the primary and most effective delivery methods focus on on-site consultations that target clientele within an individual organization.

International Involvement

There are three reasons for extension educators to involve themselves in extension at the international level (Seevers *et al.*, 1997) are:

1. Opportunities for careers and experiences abroad,
2. Gaining ideas from other systems, and
3. Educating clients on international concerns.

Involvement with international extension allows individuals with experience in U.S. extension work to apply their expertise overseas. Historically, the extension system in the United States has been very successful and this is a good story for others to hear. However, an educational program that works well in one culture may not necessarily be successful under a different set of circumstances. Gaining knowledge from other systems may also contribute to improvement of one's own circumstances. As with any good idea, "form and function" may require additional modifications to become adaptable. Exchanges also provide participants with an appreciation of other cultures and international understanding.

Issues related to food security, economic well-being and world peace are closely interrelated and the internationalization of extension involves the need to educate clientele about world economies, the effects of environmental damage, and the need to preserve the gene pool of agricultural products. The need for the production of food to feed the world's population and minimize hunger and malnutrition has increased with the population. Production should not be the only factor to consider in providing enough for everyone; distribution and storage are areas that also require consideration.

The manner in which countries organize and conduct their agricultural practices and enterprises not only has a direct effect on the country itself, but also on the world's markets and environment. Alterations in the environment due to human activity or climatic changes are global changes that may impact the food supply and the livelihood of farmers, foresters, and ranchers. Destruction of rainforests and range overexploitation are examples that threaten environmental stability. Protection of the plant and animal gene pool is also important from the perspective of diversification, which may provide insurance against disease, pests, and extremes of weather that may decimate inbred crop varieties. Monoculture agriculture practiced in the United States, where a single cultivar is planted on a extensive acreage, needs to be balanced by diversity that exists elsewhere.

Extension Implementation

Areas that are considered developing or third world countries have utilized many different approaches to extension. Axinn (1988) found that there was no "best approach", but the main approaches are:

1. Training and Visit,
2. Project Approach,
3. Farming Systems Research and Extension, and
4. Participatory.

Training and Visit System

The Training and Visit System is a wide-spread extension system developed and funded by The World Bank since the late 1970's. It has been adopted by more than 40 percent of developing countries (Hayward, 1990). It is a centrally controlled operation in which extension workers visit individuals or groups of farmers regularly. The extension workers may receive supplemental training from a team of subject matter specialists. This system is an expensive, personnel-intensive, top-down approach. Advantages to this system are the concentration of efforts on key improvements in the production system. This system has been particularly successful in

specific countries, but can also be unsuccessful when information is too late, distorted, or irrelevant (Diamond, 1994). Also, expatriates working with extension programs in other countries "should be sensitive to cultural traits that bias counterparts, extension clientele, and curriculum content" (Diamond, 1994). The Ministry of Agriculture controls extension in almost all countries outside of the United States and is contrary to the U.S. extension land-grant model that establishes cooperation among federal agencies, state universities, and local government. When extension is organized through a ministry of agriculture, such a model is vertical and hierarchical, which is compatible with the Training and Visit System.

Project Approach

Project Approach is dependent upon technology transfer within the broader concept of integrated rural development. The central government controls program planning, but foreign funding and foreign advisors are major contributors. Unfortunately, when funding ends, the project tends to cease and continued coordination among donor programs ceases to exist (Rivera *et al.*, 1989).

Farming Systems Research and Extension

This approach uses on-farm research employing actual conditions as opposed to experiments in which all variables are controlled, and requires strong commodity research support and researchers with good communication skills and travel funds to visit farmers. Ideally, in this model, farmers test, evaluate, and diffuse information informally. However, this approach has a tendency, which "enables social and technical scientists to work together to learn from but not with farmers" (Lev and Acker, 1994).

Participatory

In the participatory model of extension, activities are conducted through organizations such as farmers' associations and other groups. In the participatory action research approach, there is a "three-way collaborative learning process among social scientists, technical scientists, and farmers" (Lev and Acker, 1994).

Regardless of country of origin, all models of extension have some common characteristics, such as:

1. A sponsoring organization,
2. Transfer of information to the target audience, and
3. Promotion of change.

Challenges to extension organizations are the same everywhere:

1. Budget constraints,
2. Environmental concerns,
3. Rural-to-urban migration,
4. Need for linkages between research and extension,
5. Governmental policies that conflict with individual welfare, and
6. Communities and families with economic and social problems.

Differences that exist in extension at the international level are due to differences in philosophy. One view concurs that nations with a food shortage should expand their production capabilities. This view believes that it is important for each political entity to be self-sufficient in food. Another view supports that agricultural commodities be produced in the most favorable regions and transported to other countries, regardless of whose farmers are hurt in the process. A view held by some policy-makers is that U.S. aid to needy countries should be based on what is currently in surplus, for which the government is paying price supports. Humanitarians want to ensure that no one starves, but economists argue that giving food to other countries destroys

their prices and disrupts their supply systems. Some governments are interested mainly in extension efforts that will increase their agricultural exports and consequently their trade balance. Others are more concerned about resettling their small farmers and trying to reverse urban migration. Each of these philosophical views has proponents who extol its strengths. Which view is currently in vogue usually depends upon which political party is in power (Seevers *et al.*, 1997).

When international students were asked their views on Extension's educational philosophy and mission, they wanted their home countries to focus more on empowering people to solve local problems. In other words, the international students preferred a "bottom-up" approach arising from the viewpoint of local communities rather than a "top-down" approach from government agencies (Mohamed *et al.*, 1995). Economically underdeveloped countries have a large percentage of their population engaged in farming where systems of education, technology, transportation, and communication are limited. As a result, a central extension system may be needed to ensure that farmers have credit, supplies of seed and fertilizer, and access to markets.

Donor Agencies

Because of limited resources in developing countries, which include most of Africa, Asia, and Latin America, support for extension services has come from donor agencies, often with United States dollars, both public and private. The main agencies that support extension programs are:

1. Food and Agriculture Organization (FAO),
2. International Fund for Agricultural Development (IFAD), and
3. The World Bank.

The initiatives of the Food and Agricultural Organization of the United Nations (FAO) stress country-specific design, farmer participation, and strong research-extension links. FAO has a strong interest in reaching women farmers and encourages cooperative funding of extension efforts by central, regional and local contributions (World Bank, 1990). FAO is willing to use a variety of models and provides technical assistance to more than eighty countries. The United Nations International Fund for Agricultural Development (IFAD) is dedicated to agricultural research and small farmers. It emphasizes relatively high agent-farmer ratios and extension education for women, and includes a long-term commitment to financing the national system. The World Bank is the largest source of funds for agricultural extension in developing countries, although extension takes only one percent of the World Bank's budget (Hayward, 1990).

Governmental Sponsorship

The United States provides extension assistance through its Agency for International Development (AID) and through private contributions to non-governmental organizations. Numerous organizations support agricultural based projects overseas, with a major source of funding originating from U.S. Agency for International Development (USAID) via the U.S. Farm Bill. The U.S. Farm Bill funds the Farmer-to-Farmer Program. The program assists farmers and agriculturally based businesses in developing countries worldwide to increase food production and distribution, by improving the effectiveness of farming and marketing operations. The program relies on the expertise of volunteers from U.S. Farms, land grant universities, cooperatives, private agribusiness', and nonprofit farm organizations to respond to the local needs of host country farmers and organizations. Farmer to Farmer volunteers provides assistance to individual farm enterprises, cooperatives, farmer's associations, agribusinesses, rural credit institutions, universities, and agricultural youth groups overseas. Volunteers are recruited from farms and agribusiness's all over the United States. The average length of assignment is 15-20 days. The partner organizations that are supported by the Farmer-to-Farmer program include:

1. ACDI/VOCA,
2. Citizen's Network for Foreign Affairs (CNFA),
3. Land O'Lakes, Inc. (LOL),
4. Partners of the Americas, and
5. Winrock International.

ACDI/VOCA (Agricultural Cooperative Development International/Volunteers in Overseas Cooperative Assistance) is the leading implementor of the Farmer-to-Farmer program and is a private, nonprofit organization that promotes broad-based economic growth and the development of civil society in emerging democracies and developing countries. ACDI/VOCA's approach to agriculture is founded on business principles that help entrepreneurs and farmers improve technology by utilizing high-quality, short-term U.S. volunteer advisors. Volunteers are typically mid-career professionals with significant experience who provide the kind of expertise found in the world's most successful economy. As a result of ACDI/VOCA's approach, the impact of agricultural production, processing and marketing improvements covers a vast range of agricultural-based enterprises.

The Citizens Network for Foreign Affairs (CNFA) is a non-profit, nonpartisan organization dedicated to stimulating international economic growth in the developing and emerging world markets. CNFA builds partnerships between the public and private sectors to foster sustainable development and create market-oriented, economically viable enterprises where none or few existed before. CNFA currently works in the food and agriculture sector and is globally expanding its model of public-private partnerships into different economic sectors and disciplines.

The Land O'Lakes Farmer-to-Farmer approach concentrates on identifying areas where the program can have the best impact on economies of each of the countries in which Land O'Lakes operates. The program strives to align with the goals that the local Mission of USAID establishes within a specific country. The program matches U.S. volunteers with local organizations in the countries where program support exists. In order to concentrate resources and provide the greatest benefit to clientele, a key agricultural sector is chosen in each country that will yield the greatest impact. Activities are typically aimed at strengthening key agribusiness's by providing technical assistance on various issues of processing, marketing, and finance, which target the client's agricultural products.

Partners of the Americas utilizes the Farmer-to-Farmer program to bring together U.S. volunteers and their Latin American and Caribbean counterparts to work together to find solutions to common problems. The impacts of this program and cooperation from a volunteer network have aided in the strengthening of plant and animal production that can be seen throughout the hemisphere. Projects have focused on leadership responsibilities, providing technical assistance for agricultural production, and increased income of rural families.

Winrock International is a nonprofit organization that works with people around the world to increase economic opportunity, sustain natural resources, and protect the environment. Winrock matches innovative approaches in agriculture, natural resources management, clean energy, and leadership development with the unique needs of its partners. By linking local individuals and communities with new ideas and technology, Winrock is increasing long-term productivity, equity, and responsible resource management to benefit the poor and disadvantaged of the world. Winrock International works with farmers, local organizations, research and educational institutions, and policymakers to improve agricultural productivity, sustainability, and income in developing countries. Efforts include research, information dissemination, training and education, policy analysis and development, and improving the ability of institutions to respond to changing needs.

Citizens Development Corps (CDC) has long specialized in furthering the advancement of market economies by strengthening and promoting business, trade, investment, and entrepreneurial development. CDC is a non-profit, international economic development

organization funded by contributions from the American and international business communities, USAID, and other donors. They establish partnerships with the U.S. and international business community to design and implement innovative programs that promote and support Corporate Social Responsibility. A portion of their project focus is agriculture development.

The USDA's Foreign Agricultural Service (FAS) enhances U.S. Agriculture's competitiveness by providing linkages to world resources and international organizations. These linkages produce new technologies that improve the agricultural base and produce new and alternative products, promote mutually beneficial relationships between scientists and leaders domestically and worldwide, and connect the technical expertise of the U.S. agricultural community with counterparts in other countries. The Cochran Fellowship Program provides training to agriculturists from middle-income countries, emerging markets, and emerging democracies. They gain exposure to U.S. economic policies, agricultural business practices, and products, and they are introduced to U. S. agribusinesses, agencies, and other organizations.

Commodity Organizations

Commodity groups such as the American Soybean Association (ASA) and U.S. Grains Council (USGC) also recruit experts that are involved with technical programs that teach livestock and poultry producers how to use feed grains effectively and manage operations efficiently.

The U.S. Grains Council (USGC) develops export markets for U.S. barley, corn, grain sorghum and related products. The council believes exports are vital to global economic development and to U.S. agriculture's profitability. Founded in 1960, the council is a private, non-profit corporation of ten international offices and programs in more than 80 countries. The council tailors its programs to meet individual countries' cultures and needs. Their technical programs teach livestock and poultry producers how to use feed grains effectively and manage their operations efficiently. Their trade servicing efforts educate potential and current customers about the U.S. marketing system, including financing, government programs, U.S. feed grains quality and prices.

The American Soybean Association (ASA) leads a dynamic industry supplying soy product to the world, improving the quality of life and the environment. ASA was founded in 1920 and serves as the policy, domestic marketing, new uses, research and international marketing advocate of the U.S. soybean farmer. The American Soybean Association conducts the largest commodity-oriented soybean promotion program in the world. With nearly 100 overseas staff and consultants, ASA operates promotional and technical programs in more than 70 countries. These programs are designed to promote exports of U.S. soybeans and soybean products. Approximately half of the value of the annual crop is destined for export as whole soybeans, or processed domestically and exported as soybean meal and soy oil.

One of ASA's most innovative market development program, the World Initiative for Soy in Human Health (WISHH), was launched in 2002 to promote the use of soy products in food aid programs worldwide. Funded with producer checkoff dollars, ASA has launched this multi-faceted program to create short and long-term growth for soy markets without disrupting commercial sales. This new program leverages farmer funds with the resources of the U.S. government and international organizations. The program promotes the use of U.S. soy products in developing countries where rapidly growing populations of all income levels can benefit from soy in their diets. Activities range from identifying new uses for soy-fortified noodles to providing a corn-soy blend product, to research on how soy-based foods may provide essential nutrition to millions of people affected by malnutrition.

Educational Opportunities

The Fulbright Program was proposed to the U.S. Congress in 1945 by then freshman Senator J. William Fulbright of Arkansas. In the aftermath of World War II, Senator Fulbright viewed the

proposed program as a much-needed vehicle for promoting "mutual understanding between the people of the United States and the people of other countries of the world." Fulbright grants are made to U.S. citizens and nationals of other countries for a variety of educational activities, primarily university lecturing, advanced research, graduate study and teaching in elementary and secondary schools. Both U.S. and Visiting Fulbright Scholars lecture or conduct research in a wide variety of academic and professional fields ranging from agriculture, journalism and urban planning to music, philosophy, business administration and zoology.

The Fulbright Program is sponsored by the United States Department of State, Bureau of Educational and Cultural Affairs under a cooperative agreement with the Council for International Exchange of Scholars (CIES) assisting in the administration of the Fulbright Scholar Program for faculty and professionals. For over 50 years, the Council for International Exchange of Scholars (CIES) has helped administer the Fulbright Scholar Program, the U.S. government's flagship academic exchange effort, on behalf of the United States Department of State

Summary

The extension of the 21st century holds strong to its mission to deliver the latest in land-grant university research straight to the people. Whether the scope is local, regional, national, or international, the essence of extension supports key projects, which may include the building of partnerships, improvement of business practices, increasing productivity and profitability, and introducing new technologies. In addition, opportunities for scientific exchange contribute to an increased understanding of history, culture, politics, and social structure.

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EXTENSION REALITIES

Cultural Issues in Processing Plants and on Farms

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Introduction

The American poultry industry has undergone labor transition during the last 10 years, shifting large proportions of its hourly processing workforce from native Anglo and African-American laborers to Latino immigrants (Duchon and Murphy, 2001). While anecdotal evidence concerning the causes and impacts of this shift have been plentiful, there are few published works documenting the specific impact of the Latinization of the processing plants and processing communities.

This paper argues that the poultry industry serves as both a harbinger and caution regarding the globalization of American unskilled labor. Indeed, the poultry industry can be called an archetype of the emerging global workforce in that its reliance upon cheap unskilled labor is typical of labor immigration worldwide (Haus, 2002). The truism that either the money goes to where the poor are or else the poor will come to the money is axiomatic in poultry processing plants. It is not atypical to find processing plants having in excess of 50 percent immigrant workers, and anecdotal data indicate that some plants now employ a predominantly Latino work force. This has both positive and negative impacts. Latinos readily work for locally competitive wages, their work ethic is acknowledged to be outstanding, they do not readily unionize, and they actively recruit their relatives and friends from their native country into the poultry industry (Engstrom, 2001; Guthey, 2001).

Yet, whereas Latino labor has proved to be advantageous in some ways, these workers profoundly influence their communities by establishment of ethnic enclaves that increasingly isolate themselves, indicating that assimilation will be problematic.

Globalization and the Poultry Industry

Globalization can be defined as the flow of labor and capital across market concentration gradients, and typifies the current international unskilled labor supply (Fukuyama, 2004). Indeed, legal and illegal immigration of labor is integral to globalization as workers seek out opportunity (Jones and Rhoades, 2001). This means that industries will both recruit and attract labor that is cheaper than indigenous labor, or those industries will relocate to countries that have available, cheap labor. Stated in terms of the poultry industry, its processing labor force has long been characterized by high-intensity unskilled work opportunities, and processing plants typically have annual turnover rates in excess of 100 percent. When high turnover is coupled to labor-intensive low-skilled jobs that produce locally unattractive jobs, immigrant labor rushes to fill the employment vacuum (Huntington, 2004).

The primary causes of immigrant labor in the poultry industry include readily available employment, willing employers who actively seek immigrants, and the competitive advantages of an immigrant workforce (Guthey, 2001). Poultry industry managers readily acknowledge that human resource issues are among their most problematic concerns: turnover is high, absenteeism is endemic, and quality of labor is low. They also will readily acknowledge that Latinos overcome many of those issues: immigrants want to work and are known for high retention rates, low absenteeism (except for holiday periods when they commute back to countries of origin), and excellent work.

This being said, globalization in the context of poultry labor has had and will continue to have profound impacts on processing communities as well as regions where poultry processing is located. Anyone who has visited a poultry town in the last five years can readily attest to this fact. Currently there are two contradictory views regarding these social and cultural impacts of Latino immigration. Samuel Huntington (1998; 2004) argues that the current and coming wave of Latino immigration is not atypical of immigration worldwide in that it will be marked by a militant, sectarian unwillingness to acculturate or assimilate. In effect, he argues that Latinos who arrive for economic reasons are "employment mercenaries," and as such have little vested interest in adjusting to indigenous cultural expectations. Moreover, they bring with them the cultural norms from the old country without the intention to forgo those norms for the new expectations of their new home, thus creating a clash of cultures. Traditionally, immigrants entered the United States for both political and economic motives, and understood that they were leaving their previous ethnic identity in their country of origin to "norm" to the American ideal (Huntington, 1998). Certainly ethnic groups maintained a vestige of their identities by teaching their children about the "Old Country" and by the creation and maintenance of countless civic organizations to perpetuate their ethnicity, e.g. German-American clubs, etc. But, Huntington (2004) argues that since the new breed of Latino immigrants are not political refugees, and that they exhibit disregard or contempt for Law—after all, many are illegal aliens—-they no longer carry with them the implicit expectation that they will enculturate or assimilate, and therefore lose their distinctive identity. Indeed, he argues that they will be increasingly militant in their insistence that they be allowed to maintain their Latin heritage, language, and culture *intact.* Rather than participating in American culture as "betweeners" who have left their homes for a new homeland, they will insist on a type of Balkanized America wherein they can exist as ethnically distinct, culturally separate and stridently "Other," reaping the benefits of an economically wealthy and politically stable society while shunning the social contracts that expect them to norm to the society's expectations (Huntington, 2004).

Although controversial and provocative, the implications of Huntington's argument, if true, are profound and hard to exaggerate. Americans who implicitly understand the social contract with Latino immigrants to include their willingness to assimilate, e.g. "We let you live here as long as you become like us," will be disappointed and ultimately reactionary towards the new immigrants. Furthermore, civil strife will occur because our system is not structured to recognize and accommodate ethnicity on its own terms (McCloskey and Zaller, 1987). Lastly, the fabric of American society, with its unique historical ability to accommodate immigration deriving from the expectation of immigrant cultural and ethnic assimilation into an "American Ethos," will fray as the open doors of the American immigrant ethos, coupled with the flood of globalized labor, is increasingly detached from any expectation of commonness (Huntington, 2004; Studstill and Nieto-Studstill, 2001).

An alternative view to Huntington is popularized by David Brooks (2004b), who argues for what he calls "The Americano Dream." Yes, he concedes that this immigration is different in that recent Latino immigrants have largely bypassed the large cities, opting instead for employment directly in small agricultural towns. Cities have always served as assimilation engines, forcing an amalgamation of identities and serving as enculturation centers as immigrants interact with different groups on a day-to-day basis. The immigration into the poultry industry has bypassed those mechanisms. Brooks also acknowledges that this immigration wave is not typified by the political willingness to forgo cultural and ethnic claims in favor of an American ethos, largely because this wave of immigrants are not political refugees who are fleeing from personal danger but are instead moving toward personal economic gain (Brooks, 2004b). Nonetheless, Brooks and others argue that Latinos are indeed following traditional patterns of assimilation and enculturation (Haus, 2002). Alba and Nee (2004) argue that, with the exception of some border neighborhoods, Mexicans understand and accept that English must be their primary language—indeed, by the third generation more than sixty percent of immigrant children speak only English in their homes. Myers (2004) indicates that Latinos are indeed climbing the economic ladder: sixty-eight percent of Latinos who have been in-country for 30 years own homes, which is a typical characterization of American exceptionalism and identity (Painter et al, 2000). Likewise, Latino immigration is similar to all American immigration waves in that the

first generation is ethnically "Other," e.g. still a Mexican, the second generation is a "Betweener," e.g. neither fully Mexican nor fully American, while the third generation is a "Normer," e.g. has become Americanized (Bohon, 2001).

What Brooks argues is that adaptation and compromise will be the norm, as Americans learn and adapt to Latino culture while Latinos are similarly drawn toward a compromise-based enculturation. That is, we will become like them as they become like us, and the resulting hybridization of cultures, while not identical in outcome to what existed before they arrived, will nevertheless be remarkably similar in process to what has always occurred in American culture (Brooks, 2004a). In effect Brooks argues that, far from fraying our culture, the new wave of Latino immigration actually demonstrates American vitality and innovativeness as we once again remake ourselves into something new and unknown elsewhere in the world.

Huntington's argument borders on the apocalyptic and Brooks' thesis borders on the Pollyannaish. American culture will not disintegrate only because Latinos immigrate here for jobs in the poultry industry, nor will the immigration be marked by relatively smooth and seamless transition to a new amalgamation. Instead, a third argument synthesizes these two and adds the context of differing ethnicity and location to explain a likely outcome. Bohon (2001) posits that Latino assimilation and enculturation are largely dependent on factors of ethnicity, culture, national origin, and kinship networks. Latinos who immigrate to the poultry industry do so usually in chain networks, e.g. the first immigrants establish residency in a town, then recruit acquaintances, who then further recruit others from their home in a continuous chain of immigration. This is borne out by data that indicate that Latinos who migrate to locations where other Latinos live do much better than those who migrate to areas where no Latinos live. In effect, the pre-existing cultural and kinship networks serve as assimilation and enculturation engines, and cultural/ethnic ties serve as *de facto* employment agencies.

Bohon also argues that Latino immigration is largely marked by economic adaptation derived from the pre-existing networks, the members of which have learned to navigate and negotiate American culture. However, there are significant differences between ethnic groups' success in adaptation: Cubans, Colombians and some other "light" South Americans appear to do better, while Mexicans and Central Americans and other "dark" Latinos appear to struggle at adaptation (Bohon, 2001).

Finally, her data indicate that Latino assimilation is ethnically, culturally and regionally dependent, as well as influenced by country-of-origin and preexisting education levels. That is to say, rather than a blanket generalization that Latino poultry workers will either assimilate or won't, the reality is far more complex. Bohon makes the case that Latinos will either assimilate or disintegrate from American culture into permanent ethnic enclaves and marginal barrios and ghettos based primarily upon four factors: the pre-existence of successful ethnic kinship networks that act as mentoring engines and facilitators, a history of successful immigration from their native country to the United States, the willingness of immigrants to assimilate, and the receptivity of Americans toward the ethnic group. Lastly, Bohon states that some ethnic groups will adapt, while others will remain largely marginal to American culture (Bohon, 2001).

Implications for Poultry Processing and Production Communities

Social science data indicate that Latino immigration in to the poultry processing industry—and indeed all service sector and unskilled jobs—will continue largely unabated for the foreseeable future (Haus, 2002; Suarez-Orozco and Paez, 2002). Huntington, Brooks, and Bohon all acknowledge that demographic trends will similarly reflect an influx of illegal workers, and although they differ on the negative consequences, they all agree that changes in American culture and the workplace will be profound. Huntington laments a coming blanket amnesty coupled with a worker permit program that would enable even more Latinos to enter the US workforce (Huntington, 2004).

Some of the practical challenges facing the poultry industry include the artificial suppression of wages tied with a resulting citizen backlash, the accelerated infusion of a multi-ethnic, multi-lingual workforce in processing plants, the straining of local social infrastructures in response to new immigrants, and the development of a permanent ethnic underclass in the towns where Latinos relocate. Likewise, previous unforeseen consequences include increased biosecurity risks.

One of the most politically salient consequences of the poultry industry's reliance on immigrant labor is that local wages are artificially suppressed by cheap immigrant workers. Indeed, immigrants take jobs in processing plants at wage levels that would not recruit and retain indigenous workers at sufficient staffing levels to run the plants effectively. That is, if immigrants would not fill the current jobs at current wage structures, then the poultry industry would either have to revert to hiring local laborers at the depressed wage rate—and live with the subsequent high turnover and absenteeism—or raise rates until labor/market equilibrium is reached. Labor/market equilibrium is the level in which wages rise to a point where local, quality workers are drawn into the poultry plants. That level may be $30 per hour—no one knows—but the issue is that a willing, unskilled immigrant labor supply successfully suppresses wages below that labor/market equilibrium. More important, unpublished data indicate that elected officials and citizens in five poultry producing regions *believe* that wages are being suppressed by Latinos. While poultry industry executives may argue that wages are competitive with local wage rates, local officials and citizen opinion-leaders argue that wages in plants would rise far higher if the pay reflected the nature of the work and people's willingness to take those jobs.

While wage issues are publicly and politically volatile, in the plants Latinos will continue to express linguistic, ethnic, cultural, and religious differences that will cause strain among the multi-ethnic workforce (Dale et al, 2001). As Latinos continue to populate poultry plants, the predominantly Anglo male management force will be compelled to cross those barriers to manage their workforce (Duchon and Murphy, 2001). Likewise, the "Betweeners" will increasingly demonstrate evidence of social dysfunction, e.g. alcoholism, drug abuse, family dysfunctions, and gang behavior.

Popular accounts and anecdotal evidence certainly support the contention that local social infrastructures like education, health care, law enforcement, and housing are straining to accommodate Latinos. That trend will continue, not only because of the continued influx of immigrants, but also because of the immigrants' inability and unwillingness to assimilate (Bohon, 2001; Huntington, 2004). Thus, poultry companies in towns with a large proportion of immigrant laborers should expect both increased pressures on local infrastructures as well as increasing backlash from local native citizens who blame the companies for bringing the immigrants to town.

Interestingly, biosecurity will be a critical derivative of Latino immigration because Latinos keep house birds, they lack understanding concerning the necessity of biosecurity in high-intensity industrial animal production, and they work as "dark labor" on farms in a cash-only, black market economy. Unpublished epidemiological studies indicate that Latinos, particularly those coming from indigenous tribal backgrounds or those from rural pueblos, are prone to keep yard birds and cock-fighting birds. Also, Latinos possess little or no conceptual knowledge of farm or processing plant biosecurity, thus making educational efforts problematic. Finally, anecdotal evidence indicates that contract growers view illegal aliens and other immigrants as excellent sources of day-labor and hire them for chores on a cash basis. Importantly, after completing their chores, many Latinos transit from farm to farm to complete chores with complete disregard for biosecurity. This possible breech in biosecurity protocols occurs largely without the growers' knowledge because Latinos assure them that they are only employed on a single farm. In effect, Latino day-laborers who are hired by contract growers act as vectors of disease as they transit from farm to farm throughout the day.

Finally, and perhaps most profoundly, emerging evidence indicates that Latinos are beginning to demonstrate what Bohon and Huntington refer to as stalled assimilation. Immigrants to small poultry producing towns are far less likely to climb the socio-economic ladder, particularly those from certain ethnic groups and backgrounds (Bohon, 2001). Partly derived from the fact that small towns are poorly equipped to assimilate and manage immigration compared to larger cities, and partly stemming from the fact that many small towns have effectively walled immigrants off into impoverished barrios and ghettos, Latinos in poultry processing towns are in danger of becoming a permanent, Spanish-speaking ethnic underclass that is unable and unwilling to enculturate or assimilate. The impacts of this development—the *ad hoc* creation of ethnic islands of unskilled, uneducated and poorly assimilated Latinos by the poultry industry's quest for cheap reliable labor—is profound and hard to overstate.

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How Should Extension Support Natural/Organic/Niche Markets?

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A large number of small family farms exist in the United States – according to the 2002 USDA Ag Census (http://www.nass.usda.gov/census/), there are 2,128,982 farms in the United States and 78.2% of those (1,663,825) have sales of less than $50,000. Such farms cannot compete with the large, so-called, 'industrialized' farms so they have moved to producing products for new and/or developing niche markets.

With regards to niche markets in animal agriculture, there are three main classifications:

1. Differences in production methods (animal-welfare friendly, cage-free, free-range, etc.)

2. Natural or organic production (no antibiotics, hormones or pesticides used)

3. Designer foods (omega-3 enriched, vitamin E enriched, etc.)

There are three main areas in which farms producing for niche markets need assistance:

1. *Identification of markets* Marketing is one of the most important aspects of the niche market business. Many farmers think about how they will market their products after they have started producing them, rather than developing the markets first. To develop a potential market, it may be necessary for a group of farmers to work together to produce sufficient quantity to meet the market need.

2. *Information on how to produce a product* Once a farmer, or group of farmers, has identified a potential market, they need information on how to produce the product in a safe and economical manner. USDA has developed national standards for organic livestock production, but producers need assistance applying these standards to their production systems.

3. *Identification of sources for inputs required* The ability to obtain some inputs required for production of a particular product can often be hard to obtain in some areas, such as certified organic feed or a certified organic slaughter/processing facility.

Some examples of successful support programs in Minnesota:

* *Minnesota Institute of Sustainable Agriculture (MISA)* MISA is a unique partnership between the College of Agricultural, Food and Environmental Sciences at the University of Minnesota and the Sustainers' Coalition, a group of individuals and non-profit organizations. MISA brings together the diverse interests of the agricultural community with interests from across the University community so that they can work together to meet the needs of sustainable farmers in Minnesota.

* *Survey of research needs for organic livestock production, University of Minnesota*In September 2003, Jim Riddle, Endowed Chair in Agricultural Systems at the University of Minnesota, conducted a survey of organic livestock research needs. The results of his survey were published in January 2004 and can be found online at http://www.misa.umn.edu/Other/Livestock-Survey_web.pdf. The survey is a good resource for the development of applied research projects to support organic livestock production systems.

* *Mentoring program for organic producers – Southwest Research and Outreach Center of the University of Minnesota.* The SWROC of the University of MN has a mandate for organic research, and has 160 acres of certified organic cropland. The extension staff at the center has been developing a mentoring program where experienced organic farmers can pass on their wisdom to new comers. They have included organic livestock production into their program.

* *University of Minnesota Extension Publication:* Hogs your way – choosing a production system in the upper Midwest, (Available online at http://www.extension.umn.edu/distribution/livestocksystems/DI7641.html). This publication describes some of the options for hog production systems, and helps potential farmers decide what is best for their situation. Similar publications for potential poultry and dairy producers are currently being developed.

* *Local poultry production and processing workshops, University of Minnesota*
As part of my extension program I have given presentations at the Minnesota Organic and Grazing Conference and workshops organized through the Sustainable Farmers Association (SFA) of Minnesota. The information requested is very diverse and covers a wide variety of topics.

Extension's Role in Conflict Resolution and Consumer Education

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Abstract

The role of extension dairy, poultry, and livestock educators is evolving rapidly; and to be relevant, we must continue to provide science-based information to an ever-broadening clientele. Campus-based specialists have remained insulated from this shifting paradigm longer than field-based staff that often facilitate disputes involving agriculture. Examples of conflicts involving animal agriculture include disagreements over manure or odor regulations, animal welfare, animal cloning, and food safety (for example, sales of raw milk). The situational framework of Heifetz and Sinder, (1990) describes three situations that illustrate the shifting paradigm faced by extension specialists. In the first situation, both a problem and a solution are clear, which characterizes the traditional role of extension specialists as experts in a particular field. The second situation, where a problem is clear but a solution is not; is familiar ground for those of us trained as scientists. But the third situation, where both the problem and solution are unclear, will become more common as we tackle the larger societal issues facing animal agriculture. In 1988, Carpenter and Kennedy put forth the concept of a spiral of unmanaged conflict. Initially, the problem arises, sides form, and positions harden. But as the conflict spirals out of control, communication stops, resources are committed, conflict spills outside the community, perceptions become distorted, and a sense of crisis emerges. As livestock, dairy, or poultry extension specialists, our best opportunity is to be involved and to provide science-based solutions or alternatives before the conflict begins to spiral out of control. Once communication stops, even science-based information may be misinterpreted as advocacy. Unfortunately, in most cases we are not properly trained and do not feel comfortable in dispute resolution; and our reward systems within our universities do not properly recognize efforts in public issues education, conflict resolution, or consumer education.

Introduction

The role of extension dairy, poultry, and livestock educators is changing at an ever-quickening pace. Many of the roles played by extension educators are moving from providing technical expertise about relatively strait-forward problems with readily identifiable solutions toward more ambiguously defined problems with multifaceted solutions. Often, the solutions deal as much with societal pressures as with the technical solutions we were trained to solve as animal, dairy, and poultry scientists.

The recognition that public issues and consumer education would become increasingly important for extension educators has been apparent for some time (Patton and Blaine, 2001), but public issues education began to pick up momentum in the extension system in 1992 with the release of *Public Issues Education: The Cooperative Extension System's Role in Addressing Public Issues* (Extension Committee on Organization and Policy, 1992). Educational efforts to help extension educators to become better managers of public issues received more attention, and efforts were redoubled about the same time (e.g. Ayres, 1992). Campus-based specialists have remained insulated from this shifting paradigm longer than

field-based staff that often facilitate disputes involving agriculture, particularly land use issues that arise at the local level. Examples of conflicts involving animal agriculture include disagreements over manure or odor regulations, animal welfare, animal cloning, and food safety (for example sales of raw milk, and irradiation of hamburger). To be relevant as extension specialists, we must continue to provide science-based information to an ever-broadening clientele. A smaller percentage of the population is involved in production agriculture, our traditional clientele; and we must recognize that consumers and the public at large will continue to seek sources of unbiased information. Although we will often be perceived as biased because we often work with livestock producers, involvement in public issues education may be seen as the type of extension programming that will keep extension educators relevant in the future (Boyle and Mulcahy, 1993).

The purpose of this presentation is not to provide a comprehensive, in-depth, or expert review of public issues education. The first author and presenter of this paper is a campus-based Dairy Extension Specialist trained as a geneticist, who has little formal training in public issues education, consumer education, or conflict resolution. The second author has served on the National Public Policy Education Committee and is an expert on public issues education. However, the goal of this contribution is to share some insight into public issues education and consumer education from the perspective of an animal scientist working as an extension specialist.

Public Issues

Definitions of what, exactly, is meant by the term public issues are fleeting. Often the term *public issues* is defined by examples and takes its meaning from the contemporary issue of the day. Many of us in animal, dairy, and poultry production extension programs likely conger up a vision engulfing a range of issues dealing with environmental stewardship, land usage, and siting of Concentrated Animal Feeding Operaions (CAFO's) when we hear the term. Perhaps others think of issues like food safety or even bioterrorism at its mention. While involved in a Roadmapping effort on Public Issues at Purdue University several years ago, our committee struggled to find a standard definition. We defined public issues as "matters of concern that may involve differing interests, beliefs, values, and interpretation of information". We concluded that Extension public issues education occurs when "Extension applies knowledge and research to issues of public concern. The focus is to deliver educational programs and resources designed to enhance citizen's understanding of issues and their capacity to make informed choices and impact public decisions and policies".

The fact is that societal issues or public issues go hand in hand with conflict, and the level of divisiveness depends upon how well the issue is managed in the public arena. Often public servants, like county commissioners are called upon to assist in managing conflict. They are untrained, but often extension educators at the county level have experience in facilitating open discussions and perhaps have some formal training in issues management, which can be of immense value to their communities. The consequences of a dispute spinning out of control are enormous. In their 1988 book, Carpenter and Kennedy (1988) laid out a diagram of what they considered a "spiral of unmanaged conflict". A version of this spiral appears in Table 1. Initially, the problem arises, sides form, and positions harden. But as the conflict spirals out of control, communication stops, resources are committed, conflict spills outside the community, perceptions become distorted, and a sense of crisis emerges. Reactions in terms of citizen group activities, government activities, evolution of issues, and the psychological effect on the parties are predictable as debate over the issue intensifies.

<u>Spiral of unmanaged conflict model</u>

In a 2000 publication, Singletary et al. (2000) described how Western natural resources disputes fit the model of the spiral of unmanaged conflict. That model could easily be applied to the recent instance of a dispute over siting of a moderate-sized dairy farm (700 milking cows with plans to eventually expand to 1500) in a rural county in eastern Indiana.

Problem emerges A dairy development organization made known that a dairy farm was being planned in the county by an immigrant farm family from the Netherlands. The proposed facility would be the counties first large CAFO.

Sides form There was quickly a delineation of where people stood with regard to the siting of the dairy. To a large extent the "sides" pitted the agricultural community against other citizens, though the lines were not that clear. Local farmers supported the siting if they saw opportunity in contracts, such as feed production, heifer raising, or manure utilization; while others feared reducing property values, water quality issues, and reduced milk prices. Largely the non-agricultural community vigorously questioned the water and air quality issues. Letters were written to the editor of local newspapers opposing and defending all sides in this dispute.

Positions harden As the county council approached a decision about whether to permit the dairy farm operation, hundreds of people turned out for council meetings and hearings. Sides sought legal representation and leaders in the environmental movement began to arrive from outside the county to attend these meetings. The farm community sought input from Purdue University, Indiana Farm Bureau, veterinarians, and others.

Communication stops While this dispute did not get bogged down in courts, as many public issues conflicts do; there were many signs of disengaged communication. Both sides were stereotyped, and statements were quoted in the press regarding the national heritage of the immigrant dairy family. In another case, manure was thrown at the car belonging to a concerned citizen. At one meeting, an environmentalist put a medicine dropper of manure into a glass of water to demonstrate a point, and the dairy producer drank the glass of water.

Resources are committed County commissioners began to rely on legal advice to arrive at a decision. Existing ordinances did not prohibit the siting of the dairy farm, so the county commissioners saw no way to prevent the farm from locating in the county.

Conflict Goes Outside of the Community Experts, including the first author, were invited by the dairy development company to provide scientific-based information in order to alleviate the fears of the concerned citizens about the project. By that time, all invited speakers were perceived to be biased toward one side or the other. One commissioner was asked to recuse himself from voting, because he was a crop farmer and was therefore seen as a biased party by some concerned citizens. On a state level, the Indiana Livestock Alliance, representing many interested parties in animal agriculture was developed largely as a result of this public issues dispute, and seeks to provide unbiased information to help communities make informed decisions about dairy, poultry, beef, swine, and even elk farms.

Perceptions become distorted The county was asked to adapt an ordinance largely drawn up by environmental activists from outside the county. That proposed ordinance contained, for example, set back distances from dwellings for land application of manure that were so great they would have virtually eliminated most agricultural land in the entire county.

Sense of crisis emerges Fortunately, county commissioners, with a great deal of assistance from the county extension educator, handled this public issue well enough to prevent it from reaching this crisis state, at least to this point.

Outcome to date The farm has been allowed to proceed with its plan to construct a dairy farm. The family was able to purchase a tract of land more removed from rural residential housing than the originally proposed site. While this one farm begins construction, the underlying issues have not gone away.

Observation An educator well-trained in public resolution may have been able to help avert part of the spiral by providing the county commissioners assistance in managing the conflict. The local educator, in our estimation, had the necessary ability, but was not asked to be involved. Simultaneously, hearings were allowed to proceed with little sense of decorum and

the results were a poorly handled conflict. However it must be pointed out that all parties must be willing accept other viewpoints, or conflict management has little opportunity to succeed.

Type I to III model

Another model for understanding the types of issues we face as animal, dairy, and poultry specialists (Table 2) was proposed by Heifetz and Sinder (1990). The evolution from Type I to Type II and III problems was discussed by Ayres (1992). In the first situation, both a problem and a solution are clear, which characterizes the traditional role of extension specialists as experts in a particular field. With this type of problem an expert (e.g. beef nutritionist) is called in to fix the problem. The second situation, where a problem is clear but a solution is not; is familiar ground for those of us trained as scientists. Examples of dealing with farms in financial difficulty fit this area, since the problem is clear (profits is too low), but many solutions may be possible, ranging from increasing income to decreasing costs of production to exiting the industry. But the third situation, where both the problem and solution are unclear, will become more common as we tackle the larger societal issues facing animal agriculture. The previous example is clearly that of a Type III situation. Often, science is ill-prepared to answer the specific questions that arise, since the problem is not very well defined. It is here that the extension system has great opportunity to lead public issues education.

Cooley (1994) indicated that facilitation skills are needed more and more by extension educators, and these fit best in the conflict laden issues we address more and more frequently. "An extension agent can teach about those value differences to groups having an interest in this issue, but that teaching is not likely to change their values or result in behavior changes and agreement. On the other hand, if an agent facilitates a process that identifies the larger contextual issue…then real problem-solving and appreciation can begin".

It is clear that as specialists we will all need to develop more facilitation skills. But must we all become experts in facilitation, dispute resolution, and public issues education? Not necessarily. Patton and Blaine (2001) point out a paradigm under which two types of experts, content experts and process experts (Table 3), collaborate to address the 3 types of public issues previously mentioned. Under the Type III issues where both problems and solutions are unclear, content experts conduct issue research and analysis, whereas process experts utilize the results of that research to frame the issue in public terms and facilitate public deliberation. Nevertheless, even the content experts must be increasingly aware of facilitation techniques to ensure a synergistic relationship. Patton and Blaine (2001) go on to mention the roles of content specialists to be an issue monitor, issue researcher, information provider, technical advisor, and policy analyst; and the roles of the process expert to be a stakeholder analyst, meeting facilitator, issue framer, public forum convener, forum moderator, and facilitator in dispute resolutions.

Public issues management

Further encouragement for extension specialists to be involved in public issues education was from the National Public Policy Education Committee (2002), who saw the role of extension specialists to include networker, convenor, program designer, diplomat, forecaster, facilitator, trainer, information provider, researcher, and technical expert. That report further outlined core competencies they felt were important for successful public issues management. Though lengthy, the list provides insight as to the needs for process experts in public issues management. As content specialists we may not need all of these competencies, but will be faced with situations where some or all are beneficial. We at least need to know process experts who possess these abilities to successfully resolve public issues as they arise.

Competencies

Creating Partnerships

1. Ability to identify individuals and organizations involved in public issues and their potential roles in a public issues education program.
2. Ability to bring individuals and organizations together to create a collaborative climate for problem solving.
3. Ability to foster and maintain a fair and respectful group discussion to share information effectively.
4. Ability to frame public issues to facilitate civil communication and collaborative, creative decision making.

Collecting and Interpreting Data about Issues, Audiences and Educational Settings

1. Ability to assess readiness for and suitability of public issues education and approaches.
2. Knowledge of formal and informal decision-making processes and their relationship to public issues education.
3. Sufficient understanding of technical information about the issues to help participants identify sources of information and support.
4, Understanding of the role of scientific analysis and information to the resolution of issues.
5. Ability to recognize, understand, and value diverse perspectives held by program participants.
6. Ability to identify conditions that foster controversy.
7. Ability to prioritize essential issues and interests.
8. Ability to understand and communicate about complex issues.
9. Ability to involve individuals and organizations whose participation in the educational process is critical to the program's success.
10. Ability to identify conditions that affect participation in a public issues education program.
11. Ability to discern whether the degree of polarization among participants may detract from a successful public issues education program.
12. Ability to recognize and interpret relationships among participants, including sources of power, power imbalances, and political dynamics.

Designing Public issues Education Programs

1. Ability to choose and apply educational methods that are appropriate for program goals, issues, and audiences.
2. Ability to adapt a public issues education programs to existing situations and circumstances.
3. Ability to identify and define appropriate roles for educators and participants.
4. Ability to define and communicate a sequence of steps leading participants to their desired outcome.
5. Ability to establish realistic and attainable meeting objectives.
6. Ability to prepare meeting information, including agendas, background materials and speakers.
7. Ability to work with participants to create and follow behavioral and procedural guidelines.

Communicating Effectively

1. Ability to listen actively and ask questions effectively.
2. Ability to provide constructive feedback.
3. Ability to monitor one's own communication behaviors and those of others.
4. Ability to encourage and maintain constructive dialogue among participants.

Facilitating Group Discussion and Decision-Making

1. Knowledge of group decision making dynamics.
2. Knowledge of negotiation processes, strategies, and tactics.
3. Ability to keep participants on task and engaged.

4. Ability to help participants move from advocacy toward inquiry within a group setting.
5. Ability to explain and facilitate the process of collaborative learning, planning, and problem solving.
6. Ability to help participants to clearly define their roles in all phases of the process.
7. Ability to promote civil discourse through open and balanced discussions.
8. Ability to protect people and their ideas from attack.
9. Ability to manage multiple lines of thought and discussion.
10. Ability to organize information for efficient and effective use.

Management and Transforming Conflict
1. Ability to recognize sources of conflict.
2. Ability to intervene into the conflict in a constructive and instructive manner.
3. Ability to help participants establish ground rules of effective communication.
4. Ability to facilitate communication and information exchange in an emotionally charged climate.
5. Ability to build and maintain trust among the participants by establishing a positive climate.
6. Ability to minimize or neutralize the effects of negative emotions and behaviors.

Working with Scientific and Technical Information
1. Ability to work with multiple participants to identify data needs and sources.
2. Ability to recognize both the importance and limitations of scientific data and analysis in the resolution of public issues.
3. Ability to organize complex information in ways that make it useful to all participants.
4. Ability to manage different types of information in various educational settings.
5. Ability to organize and facilitate the presentation, interpretation, and application of information by outside experts.
6. Ability to organize the search for and analysis of data.
7. Ability to prepare technical reports.

Creating an Environment of Professionalism
1. Ability to demonstrate a commitment to honesty, integrity, and respect for all participants.
2. Ability to separate one's personal values from issues under consideration.

3. Ability to demonstrate sensitivity to participants' values and diversity, including gender, ethnic and cultural differences.

As content experts, we must bear in mind that, though we try to provide science-based information, in some public issues debates we will be seen as biased parties. This is because we frequently provide advice and support to particular clientele, such as dairy, swine, beef, or poultry farms or industries. In those cases it is often best to excuse ourselves from also being the process expert. That role may best be played by a member of a core team of experts within the state's cooperative extension service (Patton and Blaine, 2001). Working closely with process experts is necessary to face public issues head on, rather than waiting for them to go away.

Consumer Education

Though assigned the topic of addressing consumer education as well, many of the issues surrounding consumer education are similar, if not identical, to public issues. For example, recently the first author was involved in public debate bout legalizing sales of raw milk. Increasing interest in purchasing raw milk is clearly an issue of food safety and consumer education, since many are not aware of the risks of pathogens that may be carried in unpasteurized dairy products. Yet it is clearly a public issue, pitting those who want to be able to purchase unpasteurized milk for its purported health benefits versus regulators who want no part in the risk associated with raw milk. Clearly this is a case that fits the Type III public issue

scenario (Table 2). Much of the science about raw milk is very old, and often misleading, and this is likely because public research has shied away from participating in that research because the potential ramifications of either positive aspects or dangers of pasteurized versus raw milk outweigh benefits of the research (J. Warthesen, personal communication, 2002). In Indiana, proper management of the raw milk debate prevented it from spiraling out of control. Though initial reaction to Purdue University's facilitation of the public debate was suspicious, a properly facilitated meeting among all interested parties got issues in the open and resulted in a mutually satisfactory solution. The debate led to the allowance of raw milk to be available in a cow share program, where the public may co-own cows. The requirement that all owners be involved in decisions about care and management of the cows helps to ensure they are at least aware of the conditions and more responsible in the event that a mishap occurs.

All extension specialists may benefit from media relations training that is offered within the extension system and by various organizations, including many of the commodity groups with which we work. It is difficult to get agricultural information to consumers, media relations training can help educators to get the message across concisely and keep focused on the 2 or 3 main points the consumer needs to know.

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Table 1. Spiral of unmanaged conflict (adapted from Figure 1, p. 12, Chapter 1, Carpenter and Kennedy, 1998) [Note: time and intensity increase from bottom to top].

Legislation Litigation	Law enforcement Litigation	**Sense of crisis emerges**	Sanctions become issues	Motivation based on revenge Momentum out of control
Nonviolent direct action Willingness to bear higher cost	Reallocate resources to block adversaries Willingness to bear higher cost	**Perceptions become distorted**	New ideas are stalemated Unrealistic goals are advocated	Process as source of frustration
Appeals to elected officials Takeover by militant leaders	Appeals to elected officials Emergence of healines	**Conflict goes outside the community**	Threats become issues	Sense of urgency Militant hostility
Formation of Coalitions	Entry of high level managers in decision	**Resources are committed**	Issues shift: Specific to general, single to multiple	Inability to perceive neutrals
Task groups to study issues Publicity in newspapers		**Communication stops**	Issues become polarized	Power exercised Stereotyping
Emergence of leadership Issues on agenda of other meetings	Media campaign Single press release	**Positions harden**	Issues and positions are sharpened	Rumors, exaggeration Hardening of positions
Informal citizen meetings		Sides form	Individuals take sides	Intensification of feelings Expression of feelings
Letters Telephone calls	Counterletter No response	Problem emerges	People become aware of specific issues	Increased anxiety
Citizen Group Activities	Government or Industry Activities	*Conflict Spiral*	*Evolution of the issues*	*Psychological effect on the parties*

Table 2. Types of public issues, adapted from Hiefitz and Sinder, 1988.

	Type I	Type II	Type III
Underlying Problem	Clear	Clear	Unclear
Solution	Clear	Several Alternatives	To be discovered
Examples	Calcium Deficiency in Laying Hens	Farm in financial difficulty	Siting of large dairy farm

Table 3. Roles for public issues educators, adapted from Patton and Blaine, 2001.

	Type I	Type II	Type III
Content experts	Provide information	Analyze proposed solutions	Conduct issues research and analysis
Process experts	None	Facilitate public deliberation	Frame the issue in public terms. Facilitate public deliberation.

APPENDIX A

PROGRAM AND SPEAKER CONTACT INFORMATION

MODERATOR:

Theresia Lavergne
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9:30 - 9:35

Welcome
David Baker, Assistant Dean
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9:35 - 9:45

Introduction
Richard Reynnells, NPL, Animal Production Systems
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ENVIRONMENTAL SESSION

9:45 - 10:05

CAFO Update, Record Keeping and Expectations
Galen Erickson
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F#: 402.472.6362
email: gerickson4@unl.edu

10:05 - 10:25

Waste Management Alternatives: Composting, Methane Production and other Options
Lew Carr
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Lower Eastern Shore Research & Education Center
27664 Nanticoke Road
University of Maryland
Salisbury, MD 21801
T#: 410.742.1178 Ext 307
F#: 410.742.1922
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10:25 - 10:55	**Air Quality, PM2.5 and Related Concerns** Frank Mitloehner Department of Animal Science 2151 Meyer Hall University of California Davis, CA 95616-8521 T#: 530.752.3936 F#: 530.752.0175 email: fmmitloehner@ucdavis.edu
10:55 - 11:15	**Water Quantity Concerns—Are they Real? What Needs to be Done?** Teena Gunter Water Quality Services Division Oklahoma Department of Agriculture 2800 North Lincoln blvd. Oklahoma City, OK 73105 T#: 405.522.4576 F#: 405.522.4576 email: tgunter@oda.state.ok.us
11:15 - 11:35	**Urban Encroachment and How Extension can Assist Farmers** Kathy S. Kremer Associate Professor of Community Sociology Wartburg College Wartburg Blvd.-CTC309 Waverly, IA 50677 T#: 319.352.8389 F#: 319.352.8582 email: kathy.kremer@wartburg.edu
11:35 - 11:55	**Assimilation versus Accumulation of Macro and Micro-Nutrients in the Soil** Noel Andy Cole, Research Animal Scientist USDA/ARS Conservation & Prod. Res. Lab. PO Drawer 10 Bushland, TX 79012 T#: 806.356.5748 F#: 806.356.5750 email: nacole@cpri.ars.usda.gov
11:55 - 1:15	**LUNCH**
MODERATOR:	**Marcia Endres** Department of Animal Science 225C Haecker Hall 1364 Eckles Avenue University of Minnesota St. Paul, MN 55108-6118 T#: 612.624.5391 F#: 612.625.1283 email: miendres@tc.umn.edu

BIOSECURITY SESSION

1:15 - 1:35	**Development of Model Biosecurity Programs** John Shutske Biosystems and Agricultural Engineering 224C Bio Ag Eng 1390 Eckles Ave. University of Minnesota St. Paul, MN 55108 T#: 612.626.1250 F#: 612.624.3005 email: shutske@umn.edu
1:35 - 1:55	**Catastrophic Composting: Is it Safe and Effective?** Joel M. DeRouchey Department of Animal Science and Industry 126 Weber Hall Kansas State University Manhattan, KS 66506 T#: 785.532.2280 F#: 785.532.7059 email: jderouch@ksu.edu and J. P. Harner, and J. P. Murphy Agriculture and Biological Engineering
1:55 - 2:15	**What are Extension's Roles in the Early Detection of Agro-terrorism Events?** Dr. Richard Randle College of Veterinary Medicine A331 Clydesdale Hall University of Missouri Columbia, MO 65211 T#: 573.882.7848 C#: 573.864.7514 F#: 573.884.9139 E-mail: randler@missouri.edu
MODERATOR:	**Rhonda Vann** Brown Loam Branch Experiment Station 1676 Brown Loam Road Mississippi State University Raymond, MS 39154 T#: 601.857.5952 Ext. 11 F#: 601.857.2887 email: rcv2@ra.msstate.edu

INTERNATIONAL SESSION

2:15 - 2:35

OIE International Standards on Animal Welfare, EU Country Regulations, and their Impact on USA Trade and Regulations

Alex B. Thiermann
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2:35 - 2:55

Use of Antibiotics and Alternatives in the Animal Industries, What is Extension's Role?

Ron Phillips
Vice President, Legislative and Public Affairs
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2:25 - 3:15

Country of Origin Labeling

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3:15 - 3:35	**Opportunities for Extension Professionals in International Education** John Blake Poultry Science Department Auburn University Auburn, AL 36849-5416 T#: 334.844.2640 F#: 334.844.2641 email: jblake@acesag.auburn.edu
3:35 - 4:00	BREAK
MODERATOR:	**Angelica Chapa** Department of Animal and Dairy Sciences Box 9815 Mississippi State University Mississippi State, MS 39762 T#: 662.325.7465 F#: 662.325.8873 email: achapa@ext.msstate.edu

EXTENSION REALITIES

4:00 - 4:20	**Cultural Issues in Processing Plants and on Farms** Wes Jamison Director, Agricultural Stewardship Center 498 4th Avenue, NE Dordt College, Sioux Center, IA 51250-1606 T#: 712.722.6271 F#: 712.722.6336 email: wjamison@dordt.edu
4:20 - 4:40	**How Should Extension Support Natural/Organic/Niche Markets?** Jacquie Jacob University of Minnesota Department of Animal Science 405D Haecker Hall 1364 Eckles Avenue University of Minnesota St. Paul, MN 55108-6118 T#: 612.624.2766 F#: 612.625.5789 email: jacob150@umn.edu http://www.ansci.umn.edu
4:40 - 5:00	**Extension's Role in Conflict Resolution and Consumer Education** Mike Shutz Department of Animal Science 103A Poultry Building, Room 1026 Purdue University West Lafayette, IN 47907 T#: 765.494.9478 C#: 765.427.3094 F#: 765.494.9347 email: mschutz@ansc.purdue.edu